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Original Communications

MICROCYTIC, HYPOCHROMIC (IRON-DEFICIENCY) ANEMIA IN INFANCY AND CHILDHOOD: ITS RELATION TO GASTRIC ANACIDITY AND TO SIMPLE ACHLORHYDRIC ANEMIA OF ADULTS

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THE association of defective gastric secretion (partial or complete achlorhydria and achylia) with a hypochromic, microcytic anemia responding favorably to iron therapy is well known in adults—chiefly in middle-aged women—and forms the subject of a considerable literature dating from K. Faber's[1] communication of 1913. Recent papers by Haden,[2] Witts,[3] Bloomfield,[4] and others discuss and review the subject. A similar association in infants and children has almost completely escaped notice. In 1928 while investigating the histamine method of gastric analysis in infants and children one of us (A. L. G.) discovered four cases of achlorhydria associated with hypochromic anemia (Cases 1, 5, 6, and 7 of the present report). Owing to our failure to continue routine gastric analysis, no further cases were found until 1933 (Case 8), and no intensive research for them was made until February, 1935, since when the other five cases were discovered. These comprise all the patients with anemia of the type under discussion whom we have been able during this period to subject to gastric analysis.

Meanwhile, the report of Hawksley, Lightwood, and Bailey[5] appeared. Using alcohol test meals (histamine in one instance), they noted that in twelve of thirteen successive patients with "simple iron-deficiency anaemia," whose ages ranged from eight months to ten years, achlorhydria was found.

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METHODS

Gastric contents were removed in the morning, nothing having been taken by mouth since the preceding evening. A soft rubber catheter with double eye (size 14 Fr.) was used and extraction accomplished by means of a syringe. As soon as the fasting contents had been removed, histamine (ergamine acid phosphate, Burroughs and Wellcome, 1:1,000 solution) was injected hypodermically in doses of 0.01 mg. per kilogram of body weight (in some instances a little more than this). Samples collected at ten-minute (in some of the earlier work, fifteen- or twenty-minute) intervals were titrated in the conventional way, with N/10 NaOH. For purposes of convenience and comparison with conventional standards, we have adhered to the customary method of recording analytical values in terms of "degrees" of "free HCl" and "total acidity," instead of pH and buffer capacity, using Töpffer's reagent (dimethylaminoazobenzol) and phenolphthalein as indicators. The former figure expresses the number of cubic centimeters of N/10 NaOH necessary to bring the reaction of 100 c.c. of gastric juice up to pH 3.0 and the latter the amount required to bring 100 c.c. up to pH 8.4-10.0. Absence of "free HCl" indicates that the pH is more than 3.0. These criteria, while theoretically faulty, are sufficiently useful in practice for ordinary purposes.[6]

Chlorides were determined by the Whitehorn[7] modification of the Volhard method.

Hemoglobin was determined by the Sahli apparatus, calibrated by Lundsgaard and Møller's application of the Van Slyke oxygen capacity method,[8] so that the readings could be converted into grams per 100 c.c. of blood by the use of appropriate tables. Cell diameter (for calculation of the mean and construction of the Price-Jones curve) was directly measured (using round cells only) by micrometer readings of 200 cells. Cell volume was determined by the hematocrit. For purposes of reference the following normal (adult) values from Wintrobe's[9] paper are given:

Mean cell diameter (MCD)	7.50 micra
Mean corpuscular volume (MCV)	80-94 cu. micra
Mean corpuscular hemoglobin (MCH)	27-32 γγ*
Mean corpuscular hemoglobin concentration (MCH conc.)†	33-38 per cent

CASE REPORTS

Group A. Anemia With Marked Subacidity

Case 1.—I. J. Born: June 1, 1926. Cleft palate. Fed chiefly on milk. Always pale and flabby. Admitted Dec. 31, 1926.

Blood.—Jan. 3, 1927 (age, 6 months): R.B.C., 3,450,000; hemoglobin, 55 per cent (9.43 gm. per cent); MCH, 27.3 γγ. Sept. 15, 1927 (age, 15 months): R.B.C., 3,940,000; hemoglobin, 43 per cent (7.37 gm. per cent); MCH, 18.7 γγ; Jan. 16, 1928 (age, 19.5 months): R.B.C., 5,120,000; hemoglobin, 69 per cent (11.74 gm. per cent); MCH, 22.9 γγ.

Gastric Contents.—Jan. 16, 1928 (age, 19.5 months). Weight 11.2 kg. Histamine, 0.2 mg.

	Fasting	20 min.	40 min.	60 min.
Free HCl	0	0	10°	0
Total acidity	10°	10°	20°	5°
Chlorides mg. %	233	270	309	305

Summary.—Previous diet inadequate. Hypochromic anemia. Gastric analysis, after anemia had improved, showed absence of HCl in three specimens, very small amount in one; low total acidity and chlorides in all. Note large dosage of histamine.

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*γγ: one-billionth of a milligram (10^{-9} mg.)

†This value, arrived at by dividing the figure for mean corpuscular hemoglobin by that for mean corpuscular volume, expresses the amount of hemoglobin per unit of cell volume.

CASE 2.—B. T. Born: August, 1933. Atresia of anus: rectovaginal fistula. Diet: milk, cereal, orange juice, cod liver oil; very few vegetables. Pale, weak, irritable for past few months. Admitted: Jan. 25, 1935.

Blood.—Jan. 25, 1935 (age, 17 months): R.B.C., 3,090,000; hemoglobin, 20 per cent (3.43 gm. per cent); *cells nearly all microcytic;* MCV, 59.5 cu. micra; MCH, 11.1 γγ; MCH conc., 18.9 per cent. Rapid improvement on iron (see Chart 4). April 4, 1935 (age, 19 months); R.B.C., 4,690,000; hemoglobin, 69 per cent (11.74 gm. per cent); MCH, 25.0 γγ.

Gastric Contents.—April 1, 1935. Histamine, 0.1 mg. Weight, 9.1 kg.

	Fasting	10 min.	20 min.	30 min.
Free HCl	0	0	7°	10°
Total acidity	10°	3°	26°	20°
Volume (c.c.)	7	5	7	2

Summary.—Diet fairly good excepting in vegetables. Hypochromic, microcytic anemia. Good response to iron therapy. Gastric analysis, after anemia had improved: absence of free HCl in two samples, small amounts in two; low total acidity; low volumes.

CASE 3.—V. Q. Born: May 15, 1933. Birth weight, 3,170 gm. Pallor since age of 6 months and recurrent bouts of unexplained fever. Diet: milk and cereal. Appetite very poor. Admitted: Dec. 8, 1934.

Blood.—Dec. 10, 1934 (age, 19 months): R.B.C., 3,940,000; hemoglobin, 40 per cent (6.86 gm. per cent); MCH, 17.6 γγ; microcytosis and achromia. Marked and rapid improvement on iron (see Chart 3). Dec. 19, 1934: R.B.C., 5,060,000; hemoglobin, 56 per cent (9.60 gm. per cent); MCV, 78.5 cu. micra; MCH, 18.9 γγ; MCH conc., 24.2 per cent. April, 1935 (age, 23 months): R.B.C., 5,770,000; hemoglobin, 81 per cent (13.89 gm. per cent); MCH, 24.1 γγ; slight anisocytosis, mostly microcytic.

Gastric Contents.—April 1, 1935. Weight, 10 kg. Histamine, 0.15 mg.

	Fasting	10 min.	20 min.	30 min.	40 min.
Free HCl	0	0	12°	14°	10°
Total acidity	8°	14°	29°	29°	10°
Volume (c.c.)	15	6	5	9	10

Summary.—Diet defective; recurrent infection. Hypochromic, microcytic anemia. Good response to iron. Gastric analysis, after anemia had greatly improved: no free HCl in first two specimens; small amounts in last three; low total acidity; small volumes. Note large dosage of histamine.

CASE 4.—B. W. Born: June 2, 1933. Birth weight, 3,510 gm. "Mastoid" at 8 months. Otitis media at time of admission; rapid recovery after paracentesis. Diet: well balanced and adequate. Admitted: April 6, 1935.

Blood.—April 12, 1935: R.B.C., 5,600,000; hemoglobin, 57 per cent (9.78 gm. per cent); MCV, 49.5 cu. micra; MCH, 17.8 γγ; MCH conc., 36 per cent; many microcytes.

Gastric Contents.—April 11, 1935 (age, 22 months). Weight, 13.1 kg. Histamine, 0.15 mg.

	Fasting	10 min.	20 min.	30 min.	40 min.
Free HCl	0	6°	8°	18°	5°
Total acidity	16°	21°	25°	37°	20°
Volume (c.c.)	28	9	13	11	13

Summary.—Diet excellent. Acute infection. Microcytic anemia. Gastric analysis after infection had subsided; no free HCl in fasting sample: small amounts in rest; low total acidity; moderately small volumes.

GROUP B. ANEMIA WITH ANACIDITY

CASE 5.—A. B. Born: Oct. 10, 1927. First of twins. Birth weight, 1,880 gm. Not breast fed. Diet: whole milk formula; cereal and vegetable begun at 4 months. Poor appetite, excessive perspiration. Admitted to hospital May 25, 1928. Mild rickets. Pale. Spleen not enlarged.

Blood.—May 25, 1928 (age, 7.5 months); R.B.C., 4,110,000; hemoglobin, 43 per cent (7.37 gm. per cent); MCH, 17.9 γγ; anisocytosis, mostly microcytic.

Gastric Contents.—May 31, 1928. Weight, 5,500 gm. Histamine, 0.05 mg.

	Fasting	15 min.	30 min.	45 min.	60 min.
Free HCl	0	0	0	0	0
Total acidity	21°	17°	12°	10°	10°
Volume (c.c.)	10	13	12	9	10

April 18, 1935. Age, 7.5 years. Weight, 19.4 kg.

Blood.—R.B.C., 5,340,000. Hemoglobin, 82 per cent (14.07 gm. per cent). Fragility: slightly more resistant to hypotonic NaCl solutions than normal. Van den Bergh test, direct and indirect, normal. MCV, 72 cu. micra; MCH, 26.3 γγ; MCH conc., 37.3 per cent. The red cells are microcytic but contain the normal concentration of hemoglobin for their size.

Gastric Contents.—Histamine, 0.2 mg.

	Fasting	10 min.	20 min.	30 min.	40 min.
Free HCl	0	14°	40°	50°	8°
Total acidity	6°	26°	50°	60°	18°
Volume (c.c.)	40	8	8	9	5

Summary.—Twin. Low birth weight. No infections. Rickets. Hypochromic, microcytic anemia. Gastric analysis at 7.5 months: no free HCl in any specimen; low total acidity; moderately low volumes. Seven years later: no anemia but persistent microcytosis; no free HCl in fasting specimen; low normal (?) free HCl at 30 min.; total acidity below normal; volumes small.

CASE 6.—J. B. Born: Oct. 10, 1927. Twin of A. B. Birth weight, 1,620 gm. History and physical data identical in all essential respects, excepting greater pallor. Admitted to hospital on same day.

Blood.—May 25, 1928 (age, 7.5 months): R.B.C., 4,500,000; hemoglobin, 37 per cent (6.34 gm. per cent); MCH, 14.1 γγ; anisocytosis. June 11, 1928: R.B.C., 3,540,000; hemoglobin, 30 per cent (5.14 gm. per cent); MCH, 14.5 γγ; anisocytosis, chiefly microcytic.

Gastric Contents.—June 11, 1928. Weight, 5,400 gm. Histamine, 0.05 mg.

	Fasting	15 min.	30 min.	45 min.	60 min.
Free HCl	0	0	0	0	0
Total acidity	14°	10°	10°	7°	6°
Volume (c.c.)	13	13	16	12	12
Chlorides (mg. %)	278	254	201	193	222

April 18, 1935. Age, 7.5 years. Weight, 16.1 kg.

Blood.—R.B.C., 5,280,000; hemoglobin, 72 per cent (12.30 gm. per cent). Fragility: more resistant than normal. Van den Bergh test, direct and indirect, normal. MCV, 76.3 cu. micra; MCH, 23.1 γγ; MCH conc., 30.5 per cent. The red cells were microcytic and had a diminished concentration of hemoglobin.

Gastric Contents.—Histamine, 0.2 mg.

	Fasting	10 min.	20 min.	30 min.	40 min.
Free HCl	0	0	5°	8°	0
Total acidity	12°	7°	17°	32°	10°
Volume (c.c.)	55	20	18	16	13

Summary.—Twin. Low birth weight. No infections; rickets; hypochromic, microcytic anemia. Gastric analysis at 8 months: no free acid in any specimen; low total acidity; moderately low volumes; low chloride concentration. Seven years later: moderate hypochromic anemia and microcytosis; no free HCl in fasting sample or in two others; minimal amounts in two; low total acidity; moderately low volumes.

CASE 7.—K. Y. Born: May 15, 1927. Admitted July 3, 1928. Poor gain, weakness, frequent vomiting, poor appetite.

Blood.—July 4, 1928 (age, 13.5 months): R.B.C., 4,580,000; hemoglobin, 55 per cent (9.43 gm. per cent); MCH, 20.6 $\gamma\gamma$.

Gastric Contents.—July 6, 1928. Weight, 7.9 kg. Histamine, 0.08 mg.

	Fasting	15 min.	30 min.	45 min.
Free HCl	0	0	0	0
Total acidity	16°	8°	16°	8°
Volume (c.c.)	14	15	16	9

Summary.—Diet unknown. No history of infections. Hypochromic anemia. Gastric analysis: no free acid in any specimen; low total acidity; moderately low volumes.

CASE 8.—R. N. Born: July 13, 1931. Admitted July 5, 1933. Diet: "Careful analysis of food since birth showed diet had been adequate except that cod liver oil and orange juice were not started until 4 months." Recurrent diarrhea since age of 3 months; anemia at 6 months; rickets discovered at 1 year; recent vomiting after meals, and diarrhea. Pale, well nourished; moderate epiphyseal enlargements; marked abdominal distention; moderate excess of fat in stools (celiac disease?).

Blood.—July 5, 1933 (age, 2 years); R.B.C., 4,130,000; hemoglobin, 55 per cent (9.43 gm. per cent); MCH, 22.8 $\gamma\gamma$; marked anisocytosis. Iron begun July 6. July 13: R.B.C., 6,250,000; hemoglobin, 60 per cent (10.29 gm. per cent); MCH, 16.5 $\gamma\gamma$; reticulocytes, 5.1 per cent; microcytosis. July 13: fragility within normal limits; MCV, 59 cu. micra; MCH, 14.8 $\gamma\gamma$; MCH conc., 25 per cent. July 14: Price-Jones curve shows marked shift to left (microcytosis). July 15: van den Bergh test, direct and indirect, normal.

Gastric Contents.—July 8, 1933. Weight, 11.3 kg. Histamine, 0.11 mg.

	Fasting*	10 min.	20 min.	30 min.
Free HCl	2°	0	0	0
Total acidity	55°	5°	6°	4°
Volume (c.c.)	25	4	5	3

Summary.—Diet good. Recurrent diarrhea, with excess fat in stools. Celiac disease (?). Rickets at one year. Hypochromic, microcytic anemia, responding to iron. Gastric analysis: no free acid except negligible amount in fasting sample (retention); minimal total acidity and volume.

CASE 9.—J. R. Born: March 1, 1933. Birth weight, 3,620 gm. Admitted: March 25, 1935. Diet good; vegetables and cereal at 6 months or earlier. Pallor noted at 6 months; late in teething; for preceding 3 months progressive impairment of appetite, weakness, fatigue, and recently almost complete refusal to eat. Very pale, moderately undernourished; liver and spleen not felt.

Blood.—March 26, 1935 (age, 24.5 months): R.B.C., 2,370,000; hemoglobin, 20 per cent (3.43 gm. per cent); MCV, 76.5 cu. micra; MCH, 14.5 $\gamma\gamma$; MCH conc., 18.9 per cent; cells more resistant than normal to hypotonic salt solutions; van den Bergh test, normal, direct and indirect. Rapid response to iron (see Charts 1 and 2).

*Child had not been fed for over twelve hours. Many fat droplets in fasting specimen, indicating retention.

Gastric Contents.—March 29, 1935 (age, 24.5 months). Weight, 10.6 kg. Histamine, 0.15 mg.

	Fasting	10 min.	20 min.	30 min.	40 min.
Free HCl	0	0	0	0	0
Volume (c.c.)	4	6	5	5	2
Chlorides (mg. %)	256	287	323	372	244

Examination made on March 28 and March 30 after same dose of histamine showed no free acid in any specimen; total acidity, measured only in first two specimens (fasting and 10 min.) of March 30 collection, 6° and 4°. Note large dose of histamine.

Summary.—Diet good. No infections. Very severe hypochromic, microcytic anemia responding well to iron. Gastric analysis: no free HCl in any specimen; minimal volumes; low chloride concentrations; total acidity (two specimens) minimal.

CASE 10.—A. C. Born: July 5, 1934. Birth weight, 2,740 gm. Bottle fed. Diet and supervision excellent. Pallor noted at 9 months. Acute otitis media began about May 1, 1933. Admitted May 5: fever, vomiting, dehydration; dismissed May 11, improved.

Blood.—May 3, 1935: R.B.C., 4,650,000; hemoglobin, 38 per cent (6.52 gm. per cent); MCH, 14.0 γγ. Iron begun May 4. May 10: R.B.C., 4,740,000; hemoglobin, 53 per cent (9.04 gm. per cent); MCV, 61.8 cu. micra; MCH, 19.3 γγ; MCH conc., 31.1 per cent. The cell volume was definitely lower than normal, the concentration at the lower limit of normal.

Gastric Contents.—May 10, 1935. Weight, 7,680 gm. Histamine, 0.1 mg.

	Fasting*	10 min.	20 min.	30 min.	40 min.
Free HCl	--	0	0	0	0
Total acidity	--	22°	15°	27°	53°
Volume (c.c.)	±10	10	5	2	3

Summary.—Diet excellent. Acute infection subsided at time of gastric analysis. Hypochromic, microcytic anemia responding to iron. Gastric analysis: no free acid in any specimen; minimal volumes; moderate total acidity (mucus buffers?). Note large dosage of histamine.

DISCUSSION

Clinical Manifestations.—In adults, aside from disturbances directly due to the anemia—pallor, weakness, fatigability—hypochromic anemia is sometimes associated with sore tongue, atrophy of the tongue, "spoon" nails, and paresthesias.[10] None of these disturbances was noted in the present series of children. Failure of appetite was observed in several.† Respiratory infections and middle ear disease occurred in a few, and it is probable that children with the type of anemia under discussion are unduly susceptible to infection. Failure to gain properly in weight at about the time pallor was first noted was also observed. A variety of gastrointestinal disorders was met with: constipation, vomiting, loose stools, and fatty stools. No evidence of loss of blood from hemorrhage was obtained. Delayed growth was not investigated. In three cases rickets was associated

*Fasting specimen used for other purposes and not titrated.

†One Child, J. R., almost completely refused to eat for a time, which might suggest the so-called Plummer-Vinson syndrome of dysphagia and anemia.

with anemia. In one case some evidences of celiac disease were present. Jaundice was not present in any case.

The Blood.—The morphology of the red cells, the low hemoglobin content, and the various other hematologic data in the cases here reported, as well as the response to iron therapy, all correspond closely with the adult form of hypochromic anemia. The red cells in untreated cases are usually moderately reduced in numbers and show marked irregularity in size with a predominant microcytosis. They are hypochromic, sometimes extremely so. Poikilocytosis is usually present in moderate degree, but the banana-shaped cells described by Haden[2] have not been frequent. The average quantity of hemoglobin per cell is invariably reduced much more than the erythrocyte count (low color index, low mean corpuscular hemoglobin). Because of the small size of the cells, the quantity of hemoglobin per unit of cell

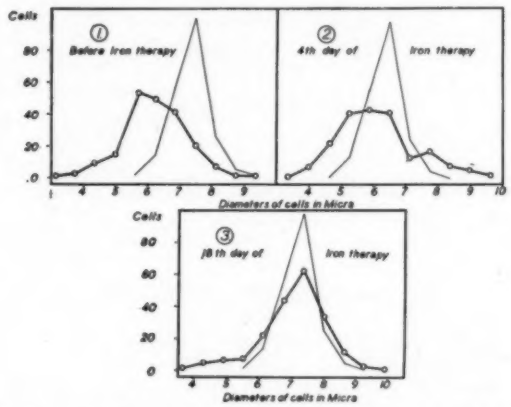

Chart 1.—J. R., aged two years. Microcytic, hypochromic anemia with anacidity, showing response to iron. Price-Jones curves.

The central curve, drawn in light lines, in each frame represents the normal frequency distribution of red cell diameters. The curve in heavy lines is the patient's distribution. Note the progressively diminishing microcytosis; the appearance of macrocytes on the fourth day, and the persistence of a small number of microcytes and macrocytes in excess of normal as late as the eighteenth day.

volume (mean corpuscular hemoglobin concentration), while also below normal, is less sharply reduced. The characteristic change in size of the cells is clearly shown in the Price-Jones curve, where the diameters of 200 cells are plotted in the form of a frequency curve (Chart 1). Before treatment the curve extends far to the left owing to the presence of large numbers of small cells, some of which are seen to be less than 4 micra in diameter. No important or significant abnormalities in the leucocyte or platelet counts or morphology were noted. The van den Bergh tests, direct and indirect, were normal. In hypotonic NaCl solutions the red cells showed normal or slightly decreased fragility.

A prompt and characteristic change in the blood was evident in every case in which iron (ferric ammonium citrate) was given in amounts of 2 gm. or more daily. This is best shown in graphic form (Charts 1, 2, 3, 4), particularly in the plots for frequency distribution of cell diameters (Price-Jones curve), for reticulocytosis, and for total hemoglobin. Before treatment microcytosis is striking and some-

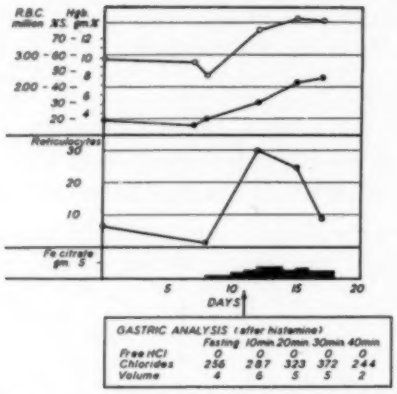

Chart 2.—J. R., aged two years. Microcytic, hypochromic anemia with anacidity, showing response to iron.

In this and the next two charts the top line represents erythrocytes; the next below, hemoglobin, and the next, reticulocytes. Note the extreme reticulocytosis, accompanied by a rise in erythrocytes and hemoglobin, occurring promptly upon the administration of iron.

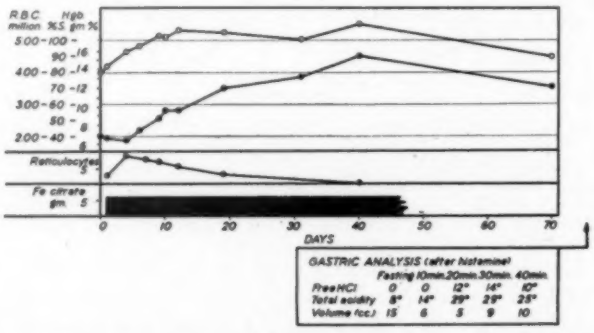
R.B.C. million
Hgb. %S gm.%
Reticulocytes
Fe citrate gm. 5
DAYS
GASTRIC ANALYSIS (after histamine)
Fasting 10min. 20min. 30min. 40min.
Free HCl 0 0 12° 14° 10°
Total acidity 8° 14° 29° 29° 25°
Volume (cc.) 15 6 5 9 10

Chart 3.—V. Q., aged two years. Microcytic, hypochromic anemia with subacidity, showing response to iron.

Here the response to iron is similar to that in Chart 1, except that the rise in hemoglobin is proportionally greater than that in erythrocytes. The exact date of discontinuance of iron is not known; it is seen to be followed by a moderate drop in both cells and hemoglobin.

times extreme (Chart 1). As the effect of iron begins, the red cells* and hemoglobin increase; there is a sharp rise in reticulocytes (in the

*When copper sulphate was used in addition to iron, we have occasionally noted an extraordinary rise in the erythrocytes to 6 million or more (see Case 9).

case of J. R., up to 30 per cent); and simultaneously the appearance of larger cells shifts the Price-Jones curve to the right of the normal. At this stage many of the cells are *macrocytic*. As the iron effect continues, the hemoglobin still rises; but the reticulocytosis declines as does the macrocytosis, and the distribution curve takes on a nearly normal character, except that an abnormal number of microcytes persists. This continued microcytosis after iron has exerted its full effect was noted on more than one occasion. The cases of the twins, both of whom were examined at an interval of seven years after the original observations, show the long period over which microcytosis (even without anemia, as in the case of patient A. B.) can persist.

While the various hematologic data, the gastric subacidity or anacidity, and the response to iron therapy point to an obvious relationship between the hypochromic anemia of adult life and that seen in

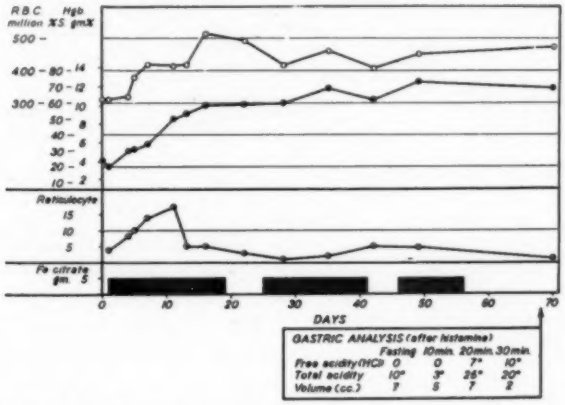

Chart 4.—B. T., aged nineteen months. Microcytic, hypochromic anemia with subacidity, showing response to iron.
Similar to Chart 3 excepting greater reticulocytosis.

young children, the chief interest of our observations lies in the fact that the type of anemia present in our cases is plainly the common "nutritional" or "iron-deficiency" anemia of early life, and that it is frequently—perhaps usually—associated with a marked defect in gastric secretion, so severe that histamine stimulation causes no free HCl, or but minimal amounts, to be produced.

The Gastric Juice.—It is regrettable that proper methods of gastric analysis have been almost completely neglected in pediatrics. With the few exceptions to be noted, all the papers published on the subject deal with gastric contents after test meals, which invariably obscure the significance of the data obtained, by the introduction of the important factors of dilution and admixture of extraneous buffer substances; the volume of secretion cannot even be guessed at. The

true character of the pure juice itself can be revealed only after a suitable period of fasting, and the histamine method is essential to determine the possible secretory capacity. There are, therefore, large and serious gaps in our standards of normal gastric secretion in infancy and early childhood. Hess,[11] and Griswold and Shohl[12] have made excellent studies of the fasting contents of the stomachs of newborn infants and have shown that in nearly all cases "free" HCl (that is, a pH of less than 3.0) is present. Neale[13] has published a study of the gastric secretion in infants and children after histamine stimulation but unfortunately does not give his results in as much detail as might be desired. (No tabulation of values for free HCl is given, and the age grouping is not altogether satisfactory.) The ex-

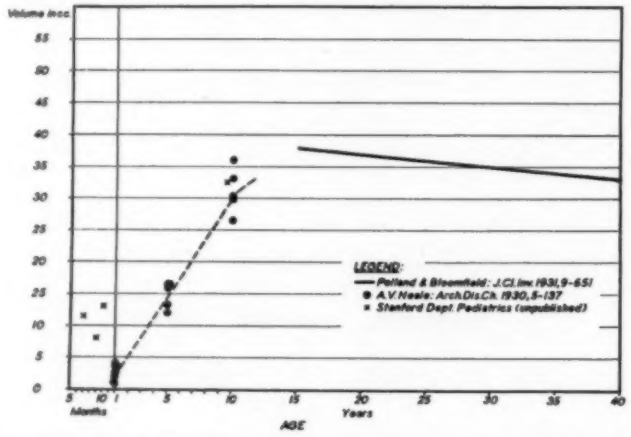

Chart 5.—Normal gastric secretion following histamine (highest ten-minute secretory volume).

Except in our own three cases (marked "x"), the scatter of the data on volume is small and the sharp rise from infancy through childhood to adult life is consistent.

cellent study of Dietrich and Shelby[14] gives no information for children under four years of age. Reference to Charts 5 and 6, compiled from the last two sources and a few observations of our own, shows that in infancy the volume of secretion is consistently small but increases nearly to adult level by the age of ten years. Total titrable acidity (buffer value), while having a similarly increasing trend with age, shows a much wider "scatter"; the median value in Neale's series of infants between six months and one and one-half years is about 65° with extremes of 25° and 115°. Free acid may be assumed to be normally present at all ages, but in amounts that, under the age of four years, are not known. In two infants aged respectively seven and ten months, without anemia and otherwise in good health, we

found maximums of 20° and 15° for free HCl after histamine. It is urgently desirable that the composition of normal gastric juice be thoroughly studied in infants and children.

In the present series of cases the juice obtained after histamine was usually clear and contained only a moderate amount of mucus. In a few instances the mucus was thicker and made some difficulty in removal of the gastric contents and also in titration. This was especially marked in cases where free acid was low or absent and the "total acidity," relatively high; the latter value then probably represented in large part the buffer effect of mucus rather than hydrochloric acid. In two instances the chloride concentration was determined, instead of total acidity, and found to be far below the normal

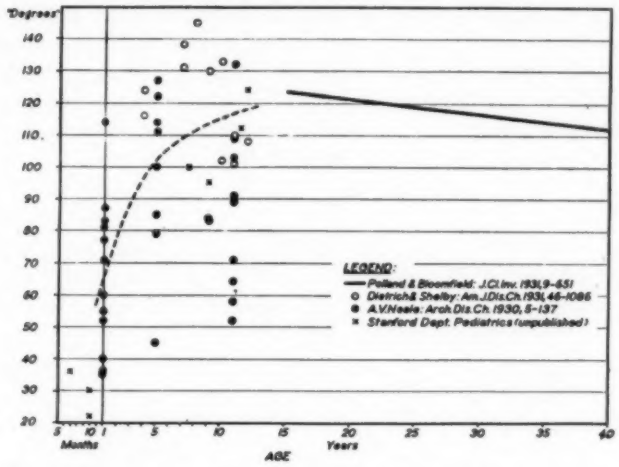

Chart 6.—Normal gastric secretion following histamine. Total acidity (phenolphthalein indicator).

The wide scatter of the data on total acidity gives the trend line a high degree of probable error. It is, however, evident that the average level increases from infancy through childhood to adult life.

of 500 to 600 mg. per cent (adult standard) and within the range of anacidity, as determined by Bloomfield and Polland.[6]

The question may properly be raised whether the small amounts of free acid noted in the first four cases of our series might be regarded as within the range of "normal" for adults. Until a thorough study of the gastric secretion, after histamine, in infancy and early childhood has been made, this question—in some respects an academic one—cannot be answered. Absolutely no normal data are at hand for the period between eighteen months and four years, and all of the children in our series were between the ages of nineteen and twenty-

four months. It is, however, probable that gastric secretion increases considerably during the second year parallel with the ability to take and digest a diet which at that age begins to approximate the composition of later childhood, and such an assumption fits the trend seen in Charts 5 and 6. Certainly in comparison with the amounts of free and combined acid and the volumes noted for children of four years and more by Neale[13] and by Dietrich and Shelby,[14] the values are very small. We have, therefore, described these four cases under the heading of "Marked Subacidity" but wish to make it clear that the description and the inference of existing pathology are tentative.

In the cases of the six children with anacidity (absence of free HCl), we are on firmer ground. Complete absence of free acid, even without histamine stimulation, is undoubtedly pathologic at all ages.

True anacidity in adults, according to Bloomfield and Polland,[6] is permanent. Whether the same is generally true of infants and children—a point of considerable importance—is unknown, but the cases of the twins, A. and J. B., throw some light on the subject. Both were examined in infancy and again at the age of seven and one-half years. The data are summarized in Table I.

TABLE I

MAXIMUM (AFTER HISTAMINE)	VOLUME	FREE HCl	TOTAL ACIDITY
A. B.			
At 7.5 mo.	13 c.c.*	0	17°
At 7.5 yr.	9 c.c.†	50°	60°
J. B.			
At 8 mo.	16 c.c.*	0	10°
At 7.5 yr.	20 c.c.†	8°	32°

*Fifteen-minute period.
†Ten-minute period.

In the case of A. B. the gastric mucosa had acquired the power, between the ages of 7.5 months and 7.5 years, of secreting juice containing a moderate amount of acid (but less than the lowest normal acidity in Dietrich and Shelby's[14] cases, which at the corresponding age was 83°), but the volume of secretion remained very small. In the case of J. B., recovery after seven years had been much less and the amount of free acid was almost negligible. Such results indicate that, while a certain degree of recovery from early anacidity is possible during childhood, a variable degree of impaired gastric secretory function in likely to persist and handicap the child, particularly in respect to normal blood formation.

We have not investigated the gastric juice in any of our cases for the presence or absence of the antianemic factor described by Castle. Castle and his associates,[15] however, noted the presence of this factor

in the gastric juice of three patients (adults) with hypochromic anemia. Liver, which has been shown to be ineffective in hypochromic anemia of adults, has not been used in our cases.

Etiology of the Anemia.—Although faulty diet—and in particular the omission of foods rich in iron, such as some of the vegetables, fruits, and cereals—may well increase the degree of anemia, it is difficult if not impossible to account for its inception on such a basis alone. Both of the twins (Cases 5 and 6) and A. C. (Case 10) had well-supervised diets from birth, with green vegetables begun at four to five months; fruits, cereal, and cod liver oil were all given at a still earlier age. The diets of R. N. (Case 8) and J. R. (Case 9) also appear to have been adequate. Nor was there a history in most of the patients of any chronic or acute precedent infection which could reasonably account for the anemia.

It seems to us much more likely that defective gastric secretion is the chief, if perhaps not the sole, factor responsible for the anemia. Not only is the anemia itself almost identical with that seen in adults with anacidity, but there is direct evidence that acid is important or essential to proper absorption of iron (Mettier and Minot[16]). Sturgis[17] in a recent review makes the following comment: "While the entire mechanism concerning the absorption of iron is not known, it has definitely been established that hydrochloric acid in the gastric contents favors the absorption of this element, whereas the absence or diminution of this acid impairs it." The prompt improvement in the blood in our cases, as in adult cases, when soluble iron in large amounts was administered, strongly suggests that the chief factor in the production of the anemia is the lack in the gastric juice of a solvent, presumably acid, for the insoluble compounds of iron in ordinary diet. The additional obstacle placed by the buffers of milk in the way of solution of iron will be presently discussed.

An important point for future study is whether or not premature and other infants of low birth weight, who are particularly subject to hypochromic anemia, show a correspondingly frequent achylia. It is interesting to note that the twins of the present series had birth weights of 1,620 and 1,880 gm.

Relation to "Normal" Conditions in Infancy.—While the cases cited here are definitely pathologic, it is interesting to note that the association of anemia and gastric deficiency shows a highly suggestive relationship to certain "normal" trends that are plainly discernible in the first two years, when the "normal" values for hemoglobin, red cell count, and gastric secretion are compared with those of later childhood and adult life. We place the word "normal" between quotation marks because we are not fully convinced that the blood picture of the first two years seen in apparently healthy children is as

a rule ideal or optimal. It will be seen in Chart 7 (taken from Mayers[18]) that average total hemoglobin during the first year* sinks precipitously to reach, at about the first birthday, a low point of 12.6 gm. per 100 c.c. of blood, and thereafter gradually and steadily rises throughout childhood and early adult life. The number of red cells, after an initial steep fall, declines steadily to about the eighth year and even, slightly, thereafter, but the erythrocyte decrease throughout is relatively much less than that of the hemoglobin. The "normal" child, therefore, undergoes during early life an impoverishment of his red cells in hemoglobin, which is brought out more clearly when the figures for mean corpuscular hemoglobin are plotted against age (Chart 8). From such data as are available, the period of very

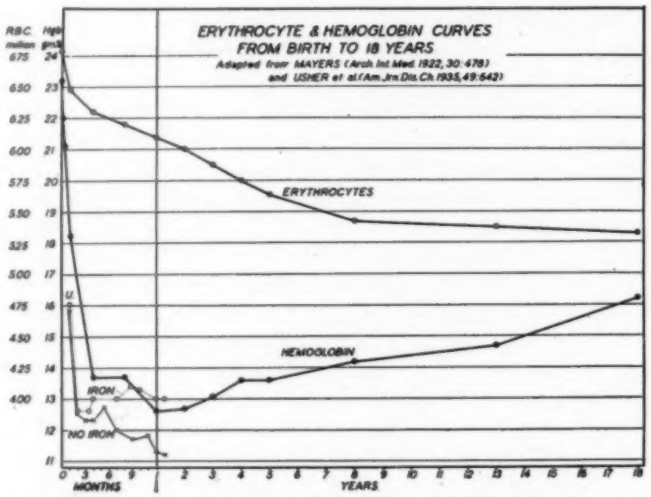

Chart 7.—Mayers' figures were selected because they include both red cell counts and hemoglobin contents. The trends shown are in substantial agreement with those found by other observers.

low hemoglobin values coincides roughly with the period of relative gastric deficiency (Charts 5 and 6). Further, the comparison of hemoglobin in infants receiving additions of iron to the diet with that in infants receiving none, as reported by Usher and his associates[19] and shown in Chart 7, indicates that some fundamental difficulty exists in iron absorption from ordinary diet in infancy, preventing the optimal formation of hemoglobin. Compared with the standards of later childhood and adult life, the blood of the average "normal" infant is in a state of mild hypochromic anemia while his gastric secretion is low both in volume and in acid content.

*We refer, of course, to the decline in hemoglobin and also of red cells which is subsequent to postnatal hemolysis.

It appears logical to us to inquire whether this state of affairs is to be regarded as wholly physiologic or, better, optimal and whether an attempt should be made to improve the ordinary regime of infant feeding in order to improve the condition of the blood. Usher and his associates[19] have shown that the routine administration of iron to infants leads to a definite, if limited, increase in hemoglobin (Chart 7), and we are inclined to believe that such therapy should be as regular a part of infant care as the giving of antirachitic and other accessory substances.

We wish to call attention to another factor of importance: the absorption and neutralization of gastric acid by milk (buffer effect), particularly by cow's milk, and its especially deleterious effect upon

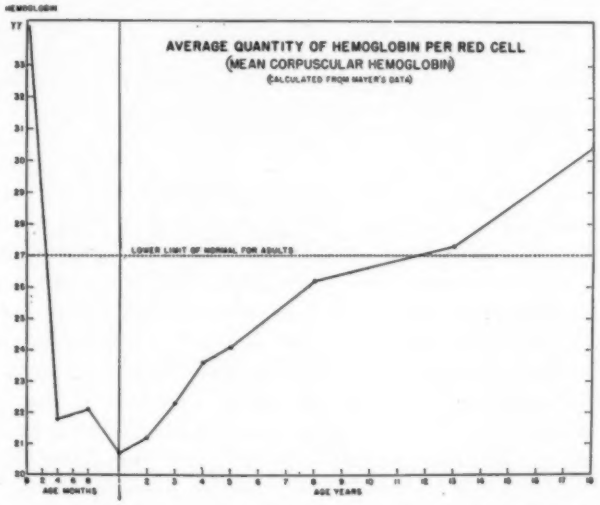

Chart 8.—The data for this chart were obtained from Mayers' figures by dividing hemoglobin by red cell count. The formula is:

$$\frac{\text{Hgb. (grams per 100 c.c.)} \times 10^{12}}{\text{R.B.C. (millions per cu. mm.)} \times 10^{12}} = \gamma\gamma, \text{ or } \frac{\text{Hgb (grams)} \times 10}{\text{R.B.C. (millions)}} = \gamma\gamma$$

The mean corpuscular hemoglobin is directly proportional to the color index when the latter is calculated by using uniform standards for hemoglobin and red cells irrespective of age, sex, or other variables.

iron absorption from food when, as in infants, the gastric secretion is small in amount and in acid content. When iron-rich foods, such as vegetables, are fed simultaneously with or shortly before or after milk, the solvent action of gastric acid upon the insoluble compounds of iron present must be nearly abolished. It would, therefore, seem wise to give the main iron-containing foods an hour or so before milk, and, at as early an age as possible, to give one milk-free meal daily, in which iron-rich foods predominate. Further, the use of acidified milk appears to have, from the aspect of lower buffer content and

consequently better iron absorption, a distinct advantage over plain milk, just as breast milk, for the same reason, has an advantage over cow's milk. It appears to be well established that breast-fed babies less frequently suffer from nutritional anemia than the bottle fed. Possibly the difference would disappear if the comparison were between breast milk and acidified cow's milk.

SUMMARY

1. In ten patients between the ages of seven months and two years with anemia of the "nutritional" or "iron-deficiency" type, gastric analysis after histamine demonstrated a marked secretory defect: free acid was absent in six and low in the other four; total acidity and volume were low in all cases.

2. The blood showed marked hypochromia and microcytosis before treatment was begun.

3. When soluble iron was administered in adequate amounts, there was a striking immediate response with reticulocytosis and increased size of red cells (transient macrocytosis) accompanying an increase in hemoglobin. This was followed by a decline of reticulocytes, by a return to an approximate distribution of cell sizes, and by a continued rise in hemoglobin. A certain number of microcytes tended to persist.

4. Twins who at the age of about eight months had anacidity and anemia were reexamined seven years later. One still had nearly complete anacidity and a mild degree of anemia. The other was able to produce a moderate amount of acid (though probably less than the normal minimum) and still had microcytosis but without hypochromia.

5. On the basis of a comparison with the normal values for later childhood and adult life, the average presumptively healthy child in the latter half of the first year and for a few years thereafter has a mild hypochromic anemia. Such figures as are available show that at least during the first and second years children secrete small amounts of gastric juice containing a relatively small amount of acid. It is probable that in this period of life the absorption of iron from ordinary diet is difficult and might be improved by administering soluble iron as a routine measure and by taking into account the acid-absorbing (buffer) effect of milk, in regulating diet.

6. The close resemblance between "iron-deficiency" anemia of infancy and childhood and the hypochromic, microcytic anemia of adults is noted.

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2398 Sacramento Street

CHILD GUIDANCE IN OUT-PATIENT PEDIATRICS

A Study of 500 Consecutive Patients

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THE Guidance Clinic from which the present report is derived deals only incidentally with juvenile delinquency and chiefly with those everyday problems of behavior and personality in childhood that have come to occupy an increasingly prominent place in the practice of pediatrics. That such problems frequently have a bearing, direct or indirect, on physical health—and vice versa—is now generally recognized. For this reason, we regard it as important that the Guidance Clinic is an integral part of the general Children's Clinic and that it, too, is staffed by pediatricians. Nearly all of our patients have first gone to the general clinic where they have received the necessary preliminary attention, and in a considerable number of instances our own examination has resulted in the discovery of physical defects not previously found. About 7 per cent of the children admitted to the general clinic are now referred to us for special investigation. The value of the service has come to be more and more generally recognized, and problems are now referred to us from various children's agencies, orthopedic hospitals, and so on. Moreover, medical students and internes are being shown the importance of the mental and emotional aspects of child health.

PROCEDURE

Our procedure begins at the first visit to the general clinic. Should the staff physician to whom the case is assigned be also on the child guidance staff, a definite effort is made to establish friendly relations during the physical examination and to bring forth the emotional relations existing between mother and child. Otherwise, the child is referred for study as soon as the need is detected by the attending physician. This is followed by a visit to the home by a social service worker trained in child guidance, in order to interpret the environment, economic situation, and general routine in terms of their influence on the child's conduct and personality. A developmental history is taken of the child's life from birth on and a brief one of each member of the household with special reference to their emotional attitudes toward each other and to the patient. Even the parents' relations to their own parents may be necessary to explain their attitudes to the patient.

From the Department of Pediatrics, Child Guidance Clinic (Dr. Mary H. Layman, Director), Stanford University Medical School, San Francisco.

To complete the history, the school is visited by the social service worker, not only for the purpose of ascertaining conduct and scholastic progress, but also to appraise the development shown by the child in this larger world group and his adjustment or maladjustment to authority and to companions both in work and play. It is the exceptional teacher who has this understanding of her charges, especially with the present overcrowding in schools.

Such helpful comprehensive histories cannot be obtained from outside agencies which make totally independent investigations. In patients sent from a long distance, as from Northern California or the state of Nevada, with the request for nothing but a mental rating, adequate detail is impossible and histories are sketchy. They are, however, included in our report since they form a significant though small part of the clinic work.

In the study of the child himself, mental and performance tests are utilized, not merely to discover his mental endowment, but as a neutral ground on which to become acquainted and as a quiet period in which the child's reactions may be studied while off guard and compared with numbers of others seen before in the same situation. Praise for good points shown in the tests leads to the lowering of defense barriers, rapport is established and the way is paved for a talk in which the child is encouraged to reveal himself and present his side of the given situation.

Consultations are held in difficult cases. The medical records are combed for factors that might possibly have a bearing on the subject, and their evaluation studied if found. Sometimes in the quiet hour or two with the child, physical signs and symptoms, such as those of nervous or endocrine disturbance, show up that were not manifested in the shorter, more active time of physical examination; while, on the other hand, some functional disorders disappear with relaxation, occupation, and removal of fears. The searching history taken by the social service worker not infrequently discloses pertinent past physical conditions not given in the regular medical history but recognized by the guidance physician as of importance, such as "spells," birth trauma sequelae, inherited defects, and the need for a Wassermann test.

An interview with the parent (parents, preferably) follows; rapport is first striven for by a sympathetic understanding of their difficulties—a very necessary procedure, since most of our children are less than ten years old and parent cooperation is vital to success. Further interviews, both with parent and with child alone, as well as repeated home and school visits by the social worker are given according to needs and available time. Helpful cooperation with the attendance bureau of the city school system overcomes the difficulty in follow-up of frequent change of residence within the city limits.

ANALYSIS OF FINDINGS

Residence.—Three-fourths of the 500 consecutive patients studied, from 1929 to 1933, lived in the city of San Francisco, seven came from the state of Nevada, and the rest from the northern two-thirds of California. The majority of those coming from long distances presented unusual physical conditions, such as infantilism, amyotonia congenita, progressive muscular dystrophy, paralysis agitans, or defects due to birth injury. Some were brought in the hope that the diagnosis, made locally, of deficient mental development would not be confirmed by authorities in the city.

Admission Complaints.—These are classified in Table I. It must, however, be kept in mind that parents are very prone to seek relief only

TABLE I

A. Problems of behavior		172 (27%)
B. Changes of personality		203 (30%)
C. Suspected mental deficiency		262 (41%)
a. Patients for placement, adoption or operation	(17)	
b. Subnormal mental reactions noted by parents	(30)	
c. Retarded physical development	(37)	
d. Reported backward in school	(90)	
e. Accompanying organic abnormalities	(110)	
(Congenital physical defects, 35; endocrine disorders, 28; epilepsy and sequelae of encephalitis, 25; sequelae of birth trauma, 16; miscellaneous rare disorders, 5)		

for actively annoying symptoms and to overlook completely the more serious signs of mental ill health, particularly the potentially psychotic changes of personality seen in children of the fearful, the nonsocial, the shut-in types, who cause little family disturbance. Nearly always these are first detected by the staff of the general Children's Clinic.

Racial Distribution.—Using the nativity or race of the parents as a basis, 51 per cent of the patients were of American origin, and the rest were from thirty-eight different countries or races. In Table II the first

TABLE II

NATIONALITY OR RACE	% OF GUIDANCE CLINIC POP.	% OF S. F. POP.	INDEX
1. Mexican	2.0	0.2	10.00
2. Spanish	1.8	0.4	4.50
3. Negro	2.2	0.6	3.67
4. Greek	1.8	0.6	3.00
5. Central and South America	1.2	0.5	2.40
6. Swedish	2.2	1.1	2.00
7. Russian	2.2	1.2	1.83
8. French	1.8	1.0	1.80
9. Italian	6.2	4.3	1.44
10. Irish	3.2	2.6	1.23
11. English	1.4	1.7	0.82
12. German	2.6	3.2	0.81

column represents the percentage of patients in our group; the second, the percentage which the given nationality or race forms of the general population of San Francisco; the third (first column figure divided by the second) gives an index of the observed frequency of guidance problems in a given nationality as compared with the expected frequency on the basis of population alone. The table is arranged in order of the magnitude of the last (the most significant) figure.

Noteworthy, as indicating unsatisfactory conditions for the mental health of children, are the extremely high figures for the Mexican, Spanish, Negro, and Greek families. Conversely, it appears that the English and German families provide a particularly favorable milieu.

Sex Distribution.—In our group there were 302 boys (60.4 per cent) and 198 girls (39.6 per cent). The proportion of boys was slightly higher than in the general Children's Clinic where the ratio in two samplings of 500 children was 56 per cent boys and 44 per cent girls. In the fifteen-year group alone did the girls predominate, and for special reasons. With one exception, all the girls of this group were hopelessly backward in school and, unable longer to bear the resulting humiliation, took refuge (in half the cases) in neuroses, most frequently fainting spells, without organic basis.

The differences in the problems of the two sexes is brought out sharply by the girl-boy ratios in Table III. In conduct problems (those in which reactions are vented on the environment), boys exceeded in the more aggressive ones. A sex difference can also be detected in the types of personality problems (those in which reactions cause changes within the child himself).

TABLE III

RELATION OF SEX TO SPECIFIC PROBLEMS

CONDUCT	GIRLS:BOYS	PERSONALITY	GIRLS:BOYS
Negativism	5.0 : 1	Jealousy	3.5 : 1
Laziness	2.9 : 1	Imaginary ills	3.2 : 1
"Bossiness"	2.0 : 1	Apprehensiveness	1.9 : 1
Nail biting	1.8 : 1	Fearfulness	1.4 : 1
Stammering	0.7 : 1	Sensitivity	1.3 : 1
Stubbornness	0.7 : 1	Timidity	1.2 : 1
Thumb-sucking	0.5 : 1	Inability to get on with other children	0.7 : 1
Destructiveness	0.4 : 1	Tics	0.7 : 1
Disobedience	0.3 : 1	Irritability	0.6 : 1
Truancy	0.3 : 1	Nervousness	0.5 : 1
Unruliness	0.1 : 1	Restlessness	0.5 : 1
		"Spoiled"	0.4 : 1

Age Distribution.—Fig. 1*a* shows the age at admission of patients in the Guidance Clinic as compared with the figures for the general Children's Clinic. Of special interest is the peak at seven years. Of our patients, 14 per cent were seven years of age. The seven-year peak is

in sharp contrast to that of fourteen years in Ackerson's patients from the Institute for Juvenile Research, which is not connected with an outpatient department (Fig. 1*b*) and shows the great advantage of such a connection in bringing guidance problems under the influence of mental hygiene at a much earlier age than is otherwise possible. The striking correlation between physical and mental age (r 0.85 ± 0.03) in our series as compared with the four-year lag for mental age in Ackerson's group (Fig. 1*c*) shows a prevailing lack of mental deficiency in our material and a considerable amount of retardation in his.

The advantage of seeing so many patients by the seventh year is particularly important because it is the age at which formal schooling,

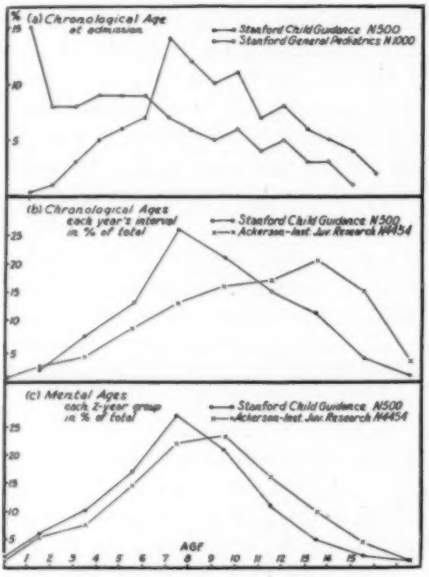
% (a) Chronological Age at admission
Stanford Child Guidance N500
Stanford General Pediatrics N1000
(b) Chronological Ages each year's interval in % of total
Stanford Child Guidance N500
Ackerson-Inst. Juv. Research N4454
(c) Mental Ages each 2-year group in % of total
Stanford Child Guidance N500
Ackerson-Inst. Juv. Research N4454
AGE

Fig. 1.

with its various and serious stresses of readjustment, is beginning. We shall discuss the matter more fully later on. During this transition period nervousness greatly increases; it affected 28 per cent of our six-year-olds and 38 per cent of our seven-year-olds. Enuresis reached its maximum in the seventh year.

Family Constellation.—The supposed beneficent effects of large families on mental health of children are apparently not wholly confirmed by our findings. While large families (five to fifteen children) constitute 4 per cent of the families of San Francisco, they made up 13 per cent of the families bringing children to the Guidance Clinic. The parents of such families, however, are likely to be improvident. In 32 per

cent of the families studied by us, one or both parents were drunkards, immoral, irresponsible, or of low mentality; another 17 per cent maintained poor or very poor homes. Thirty per cent of the children of large families were of subnormal mentality, and another 17 per cent were dullards. Epilepsy was present in 18 per cent of the large families.

Unexpectedly, "only" children did not occur in our Clinic in larger proportions than in the general population. In two-child families the first-born had a greater number of difficulties, by 8 per cent than the second-born. In families of three or more children, the first-born showed less than the proportion of problems to be expected from their ratio to the general population. Again, the number of personality problems per child in two-child families was more than twice as great as in one-child families and one and one-half as great as in three-child families. Acts of delinquency by boys were twice as great in one-child as in two-child families.

"Spoiled" children constituted 10 per cent of the whole and occupied but three places in the family constellation: first-born, 55 per cent; next to last-born, 12 per cent; and last-born, 33 per cent; with a ratio of five boys to two girls. Faulty parental control was found in 34 per cent of all cases, but more of the spoiled children developed behavior problems than did children with little or no discipline at home.

In 167 (17 per cent) of the 926 parents of whom a description was obtained, manifest unfitness for parenthood was found. Fifty-four had deserted their families; 50 were recorded as immoral, 28 were drunkards; 25 were insane; 23 had illegitimate children; 20 were cruel; 17 had jail records; 10 were delinquents; 8 committed suicide; 4 were gamblers; and 2 were drug addicts. Twenty-five parents were noted as irresponsible; 9, as "queer"; 9, as psychoneurotic. Sixty-nine of the children of these parents presented behavior problems; 40 had serious physical defects; 38 were of low mentality; and 40 had marked nervous traits. Nearly all of them had already been placed under custodial care (Children's Agency, and others). Of all children committed by court order to the care of the Children's Agency, 54 per cent were mentally subnormal.

Broken homes occurred in the case of 38 per cent of our children, a figure not much larger than the 33 per cent for normal children. A common finding, and one of much importance, was misbehavior due to repeated psychic trauma by parents—impulsive acts of discipline, cruel teasing, manifestations of hatred, odious comparisons with the other children, jealousy of the child for sharing the affection of the other parent, and the like. In such cases, misbehavior represents an inarticulate protest against injustice.

Nervousness frequently interacts between parent and child to cause misbehavior; 54 per cent of the children of nervous parents were them-

selves nervous. The tendency is increased by overcrowding in schools and by unemployment in the home, where the unemployed member is likely to be discontented and irritable toward other members of the family. Parents of superior education who had fallen into the lower economic classes were designated as nervous in 42 per cent of the instances.

Conditions in the home (excluding personnel) on the basis of suitability for bringing up children were found to be as follows: very poor, 8 per cent; poor, 17 per cent; fair, 31 per cent; satisfactory, 22 per cent; good, 20 per cent; superior, 1 per cent.

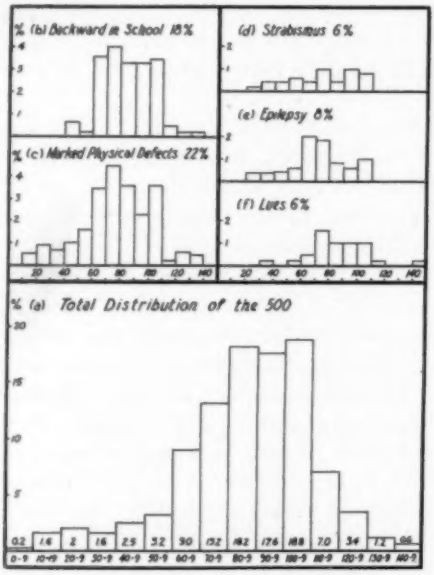
% (b) Backward in School 18%
(d) Strabismus 6%
(e) Epilepsy 6%
% (c) Marked Physical Defects 22%
(f) Lues 6%
% (a) Total Distribution of the 500
0-9 10-19 20-29 30-39 40-49 50-59 60-69 70-79 80-89 90-99 100-109 110-119 120-129 130-139 140-149

Fig. 2.

Level of Intelligence.—Fig. 2*a* shows the frequency distribution of the intelligence quotients of our 500 children. Twelve per cent of them were of the bright or superior class (I.Q. 110-150); 55 per cent were normal (I.Q. 80-110); 13 per cent were of borderline intelligence (I.Q. 70-80); and 20 per cent were mentally deficient. The distributions for the sexes were similar. The median I.Q. was 90, showing that as many problems arose in children of average intelligence or better as among those with less.

Ninety children, or 18 per cent of the total were referred to us for backwardness in school (not including the obviously high grade defectives). The I.Q. distribution (Fig. 2*b*) is of great interest: 40 per

cent of the group had sufficient intelligence to accomplish school work without retardation and another 5 per cent were actually of superior intelligence.

Congenital physical defects occurred in 110 children and, as shown in Fig. 2*d*, were often (55 per cent) accompanied by mental deficiency. Further (Figs. 2*d*, 2*e*, 2*f*), 17 (61 per cent) of the 28 children with strabismus were mentally subnormal; 27 (69 per cent) of those with epilepsy, and 12 (41 per cent) of those with syphilis. The physical defectives, whether or not mentally defective, suffer from the special handicap brought about by the merciless, if thoughtless, cruelty of normal toward abnormal children. Timidity, fearfulness, sensitiveness, nervousness, and inability to get on with other children—all traits expressive of a sense of inferiority—were found about 10 per cent more frequently in the physically handicapped group than in the rest.

Children of superior intelligence (I.Q. 110 or over) tend not to control behavior and to express maladjustment in personality changes.

Nail biting, which occurred in 15 per cent of the boys and 22 per cent of the girls, was not affected by the level of intelligence, by age, or by position in the economic scale.

Recommended Treatment.—Table IV affords a review of the main problems discovered in the Guidance Clinic and the general methods proposed for their correction.

TABLE IV

RECOMMENDATIONS MADE

More constructive activity suitable to age	15, 3%
Change in methods of discipline	29, 6%
Readjustment of recreational needs	37, 7%
More independence to be developed	51, 10%
Special training in the home	52, 10%
Social adjustment to be improved	54, 11%
Position in the home to be made more secure	55, 11%
Regulation of health habits	84, 17%
Additional medical measures	100, 20%
Change in general environment	105, 21%
Modifications in schooling (22 different items)	128, 26%

DISCUSSION

Having presented an analysis of our material and having outlined the major basic problems brought to us for solution, we now turn to some of the difficulties, mainly environmental, which must be overcome if treatment is to be successful. Clearly enough the maladjusted child requires readjustment, but it is perhaps not so clearly or universally understood that, as a rule, it is the child's environment which primarily needs readjustment; that once hampering and warping circumstance is corrected, the child will usually follow his basically normal trends and respond with healthy, normal behavior. This is true particularly of

younger children, most of whom have not passed the term of curability; it becomes less and less true as age advances and maladjustment more and more fixed, reaching an almost complete incurability with early adult life.

The maladjustments we have encountered could be traced in the great majority of instances to three places: the home, the school, and the neighborhood, in the last of which the moving picture theater is assuming enormous influence. Each of these sets its own peculiar pattern of mental or emotional imbalance upon the child.

The Home.—Guidance in parental discipline is essential to successful treatment. Desirable standards of conduct cannot be attained if lax, inconsistent, or excessive discipline persists, especially if one parent is severe and the other indulgent, or if parents disagree on discipline before the child. Again, treatment must extend to increasing the parental sense of responsibility if the execution of necessary recommendations is to be rendered possible. Other outlets are to be sought for the domineering parent who dwarfs the child's independence and stirs up revolt that is expressed in abnormal behavior reaching its culmination in adolescence when the revolt, if active, blazes out as open rebellion and, if passive, evolves into serious personality changes, often of a prepsychotic nature. Parental oversolicitude needs, not only investigation into cause, but also redirection into other channels; for, when expended solely on the child, it leads to immaturity of development, oversensitiveness, self-centeredness, and possible hypochondriasis. Unpleasant scenes in the home of a nature that arouse emotional conflicts in the child are to be avoided in his presence if disfiguring scars on his personality are to be prevented.

Some serious fear neuroses have been traced to parental discussions in the family circle of subjects of special horror to children, such as kidnaping and child murder. In children of reading age, the basis for such fears has already been laid by sensational newspaper stories and by the vividly illustrated ten-cent "thrillers" of the chain stores. The anxiety state is augmented by mystery stories heard over the radio.

At present little can be done about the overcrowding in small houses and apartments, a condition increasingly common in cities during the depression years, which creates a nerve-racking atmosphere definitely unfavorable to children. Nor can the emotional stress occasioned by the presence of an idiot or imbecile in the home be remedied until room is provided in institutions for their care.

With cooperative parents, many difficulties can be ameliorated. It is, however, discouraging to find that the intensive health-habit campaign of the past decade has had many undesirable by-effects, partly traceable to commercial exploitations in advertising literature, partly

to exaggeration of the importance of the slightest degree of supposed "underweight." We find fewer instances, today, of ignorance of the rules of good diet and habit than of overconsciousness of calories, minerals, and especially vitamins. The first is comparatively easy to correct. The second, with its tendency to faddism, is less amenable to correction, frequently leads to extreme negativism toward food with accompanying malnutrition, and arouses an antagonism to authority that bears bitter fruit in adolescence.

The Neighborhood.—Here begin such valuable experiences in the world outside the home, such as those gained by play with other children, by visits into other homes, and by errands into nearby stores—all tending to the social understanding and adaptation so greatly needed in after life. Much care should be expended in selection of a neighborhood that will provide numbers of playmates and afford profitable experiences without degrading influences. Too much adult companionship is to be avoided as crippling to well-rounded development. Clubs, Scouts, and welfare organizations have proved very useful in this socialization.

The moving picture theater has created a very important group of problems for our clinic children from the age of four years upward. Not only does the unwholesome craving for excitement and thrills thus fostered lead to dissatisfaction with home reactions; but principles of right and wrong became confused from seeing repeatedly wrongdoing rewarded or followed by little or no punishment, the practice of nonchalantly removing one's enemies by violence applauded, and the law and law enforcement belittled. Shooting and killing games have superseded all others as the favorite play of younger children, who are often decked out for the purpose by indulgent parents. Dissatisfaction with the home becomes still more acute to the adolescent who is irked by the home lack of easy money without work as in cinema life and whose standards of dress, home furnishings, and ideals of American home life are set by the fascinating scenes of the films.

In our older children, particularly the adolescent and preadolescent girls, self-identification with sensuous movie stars in scenes of love-making, often extremely vivid, has been commonly found to result in an unwholesome precocity of sexual thought and phantasy. In several girls of the shut-in type, the flight from reality into such phantasy threatened to become serious and was difficult to handle. Forbidding such movies does not prevent the revival of mental pictures, for they are recorded on the sensitive minds of children with photographic clearness and permanence of detail and are recalled with the greatest ease whenever there is felt the need of escape from the dull routine of school or from the general monotony and drabness of everyday life.

The movies have also shown undesirable effects upon young subnormal children. The fictional world of the films is presented so much

more vividly to them than the real world and with so much emotional stress that a strange distortion of values occurs, making such children still more difficult to teach and train. They feel that wild jungle scenes, cow shootings, or gangster murders may be taking place down dark basements, behind gratings, in vacant lots and warehouses; all leading to an almost intractable state of confusion and fear. While we deal only incidentally with criminally delinquent children, we have seen a number of mentally subnormal children from nine to twelve years of age who have taken refuge from their failures in phantasies of heroic defiance of the law and its officers, even though they had not as yet become the suggestible tools of gangs.

Movie scenes are assimilated into the emotional life of the child and transformed into behavior patterns that from countless repetitions bring forth deeply rooted behavior with which it is most difficult to cope. In addition, a great deal of the fearfulness, nervousness, irritability, restless sleep, and general lowering of well-being is in our experience traceable to the movies. Since parents are rarely able to prevent attendance, the chief hope of improving conditions lies in the changing character of the films themselves.

The School.—The greatest number of our guidance problems was provided by the school. Much progress has recently been attained in the schools themselves by providing special care for certain types of handicapped children. Our 69 children of subnormal mentality were well adjusted in special classes. Defective vision (15 of our cases), deafness (11, not including deaf-mutes), defective speech (57) are all handled in the schools. Other problems, however, remain. Of these, the promotion problem is one of the worst. As the result of various sorts of pressure, children are often promoted beyond their actual capacities, and the necessity of undertaking advanced work before the preliminary steps have been mastered condemns them to certain inferiority. The same cruel effect, perhaps even more severe, is produced by demotions. Both result in antisocial behavior, truancy, stealing and other related problems, particularly among adolescents.

Much of the substitution hysteria of girls and the deep antagonism toward school of boys in junior high school has its source in the present method of teaching reading solely by the visual method. In every class is to be found a sizable group of such children who cannot master reading mechanics without the auditory and kinesthetic methods that are now out of vogue. Their failure to attain the facility needed to handle the greatly increased reading assignments of this school period leaves them in hopeless despair and results in serious maladjustments.

The speed drill, a prevalent and badly used form of training in school, is a common source of maladjustment. Obviously no learning process, whether typing, piano playing, or arithmetic, should be speeded up be-

fore accuracy has been attained. Too frequently forty or more pupils are raced at top speed regardless of the unfavorable effects of such feverish activity on the learning process, on the emotional balance, and on the stability of the nervous system.

Two groups of children present particularly distressing and rather hopeless maladjustments: the children of superior intelligence and those of dull normal intelligence. In the first, all initiative and leadership qualities are suppressed, and the child remains mentally starved since the curriculum is adapted to the capabilities of the dullest pupil who will gain regular promotion. Skipping grades merely substitutes a later emotional and social maladjustment for the present intellectual one. Provision for developing the unusual mental endowment of these children has not yet been made because both the financial budget and the difficulties of teaching would be greatly increased thereby. The second group is composed of those children who, while not mentally defective as the term is commonly understood, are incapable of benefiting by formal schooling after the ages of twelve to fourteen years and are compelled by law to attend school until eighteen years of age. Nothing is done to prepare them to earn their own living or to develop skills that might be of service to themselves or to the world. They simply mark time and add to the army of social malcontents. The trouble here is faulty legislation.

Another common problem with us is the "language school," conducted daily, after regular school hours, in the native tongue by the Chinese, Greeks, Italians, Japanese, Russians, and other racial groups, with resultant maladjustments and, in many cases, serious effects upon general health from fatigue and other causes.

In 100 of our mentally retested children we were able to evaluate the effects of ameliorative treatment on maladjustment. Curiously it was found that the degree of improvement varied inversely with the degree of mental capacity, as shown in Table V.

TABLE V

GROUP	PERCENTAGE IMPROVED
Morons	70
Borderline	61
Dull	66
Slow normal	55
I.Q. 100 or more	37

These figures suggest that the more deeply the pride of the parent was cut, the greater was the effort made to carry out treatment.

Follow-up was not always needed or possible. Of 248 children of whom we have suitable follow-up records, 59 (24 per cent) were "much improved"; 90 (36 per cent), "improved," 15 (6 per cent) showed "no

change," and 5 (2 per cent) were "worse." Thirty children were transferred to state institutions. In 20 per cent of our cases medical measures of various sorts were recommended and carried out with no special difficulties.

We wish to add in conclusion that a cooperative program, such as we have attempted, between a general children's clinic and a child guidance clinic is of value in a number of important ways. The Child Guidance Clinic aids the medical work of the out-patient and hospital services by supplementing diagnosis, prognosis, and treatment; by estimating the mentality of the congenitally abnormal, the changes in intelligence caused by brain tumors and other encephalopathies, the effects on mind and behavior caused by endocrine disorders, the mental deterioration following epilepsy, encephalitis; and in some cases by determining the desirability of corrective operations. It helps the child by promoting parental understanding of and sympathy for his problems and by giving him, in the later years of childhood, a directive insight into his own behavior, thus affording a basis for the prevention of psychoses. It improves conditions in the home by reducing friction and maladjustments and so creating an atmosphere more favorable to well-balanced personality with less of the warping and twisting that permanently imperils later happiness. In general, the improved social adjustment enriches living, permits a fuller realization of native mental endowment, promotes greater independence and reliability, and so lays the ground for later success in domestic, social, and business relations.

TETANY IN THE NEWBORN

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TETANY in the newborn is sufficiently uncommon that the reports in the literature are few. Three cases are reported here, the first two being recognized at five and seven days of age and the third in a premature infant one month old.

REPORT OF CASES

CASE 1.—E. M., a female child, five days old, was admitted May 17, 1934, with a complaint of cyanotic attacks since birth, difficulty in nursing since birth, and twitching of body for two days. The infant was born full term with a birth weight of 7 pounds 9 ounces. The delivery was normal. After birth, the baby was cyanosed and difficult to resuscitate; an x-ray examination revealed a collapsed left lung with a widening of the mediastinal shadow thought to be caused by the thymus. X-ray treatment was given for the thymus enlargement. There was some improvement. Since the baby would not suckle at the breast, the mother's milk was pumped and the infant was fed from a bottle. On the morning of admission when it was noticed that the baby was twitching, our observation of the baby commenced. The twitching had been seen by mother on the third day but not by nurse. Examination revealed a small female infant, at first quiet; then when disturbed, she began to cry. There was an inspiratory crow; the baby became cyanosed due to difficulty in getting the air back into the chest. The hands intermittently assumed a carpopedal position. The child began to twitch while being examined, at first just on the right side, and later the twitching spread to the left side. Chvostek's sign could not be elicited.

The child was transferred to the Children's Hospital.

The bleeding time was 15 minutes, and the clotting time was 10 minutes. The spinal fluid was blood tinged, probably from trauma, as the cells were not crenated. The blood calcium content was 7.2 mg. per 100 c.c. The phosphorus content was not determined because not enough serum was obtained. Ten cubic centimeters of a 10 per cent calcium gluconate solution were given intramuscularly, and the child was given a transfusion. The twitching ceased; the bleeding and clotting times returned to normal. Since the baby was returned to the mother the day following admission, the blood calcium determination was not repeated. A blue spell and twitching were again observed three days later; these were controlled with 10 c.c. of 10 per cent calcium gluconate given intramuscularly. Since discharge the baby has progressed normally. Ten drops of viosterol* and 30 grains of calcium chloride were given daily for one month.

The mother's blood calcium was 10.4 mg. and phosphorus 3.7 mg. per 100 c.c. The mother had been taking 15 minims of radiostoleum* daily throughout her pregnancy. She had noted no unusual symptoms.

CASE 2.—A full-term, one-week-old baby, a third child, was brought to the hospital for admission. The parents had noticed convulsions and twitching for three days. The labor was spontaneous and easy. The baby was breast fed until admission. Three days before admission the baby had a "convulsion," twitching

From the Research Laboratories of the Department of Paediatrics, University of Toronto and the Hospital for Sick Children, under the direction of Alan Brown, M.D., F.R.C.P. (C).

*Equivalent to 250D Steenbock units.

of arms and legs lasting from five to six minutes. There was difficulty in drawing air into the chest. The following day a similar attack occurred, and on the day before admission there were four similar attacks. Physical examination revealed nothing unusual. Chvostek's and Trousseau's signs were not obtained. The cerebrospinal fluid was negative. The serum calcium content was 5.7 mg. per 100 c.c.; the phosphorus content was not determined. The child was given 75 grains of calcium chloride daily by mouth for one week. There has been no recurrence of the convulsions.

CASE 3.—A premature baby, one month old, was admitted with a complaint of "seizures" for five days. The birth weight was 3½ pounds. The delivery was normal; the mother had high blood pressure. The baby had been fed on milk, water, and sugar formulas from birth and weighed 4 pounds. Five days before admission the child had a "seizure" followed by two more that day. Since then the "spells" had been quite frequent. The patient was a poorly nourished, small female. When she cried, there was a definite inspiratory crow. There was a fine twitching of the hands and legs. Chvostek's sign was easily elicited. The serum calcium content was 5.2 mg. per 100 c.c., and the phosphorus content was 11.1 mg. per 100 c.c. This was checked by duplicate determinations. Five cubic centimeters of a 10 per cent solution of calcium gluconate were administered by mouth. Convulsions stopped for one day; then the child started to twitch slightly. The baby collapsed and died very suddenly immediately after a feeding.

CASE 4.—This case is mentioned because the blood calcium content was higher than is usually accepted in a diagnosis of active tetany. The baby, three days old, was admitted because of convulsions for one day. The labor was prolonged, and resuscitation was difficult. The baby began to twitch after thirty-six hours and continued until admission. Physical examination revealed a well-developed male child showing intermittent convulsive movements and nystagmus. Since the birth weight was 6 pounds 13 ounces and admission weight was 6 pounds 5 ounces, there was no question of edema. Cerebrospinal fluid was not obtained when lumbar puncture was attempted. The blood serum calcium content was 8.8 mg. per 100 c.c. The phosphorus level was not determined. Five cubic centimeters of a 10 per cent calcium gluconate solution were injected intramuscularly, and 50 grains of calcium chloride were administered by mouth for three days, followed by 30 grains for two weeks. The convulsions, twitching, and nystagmus disappeared in twenty-four hours, and subsequently there has been no recurrence.

Although this child did not definitely have tetany of the newborn, the course after the administration of the calcium suggests that the low serum calcium may have predisposed the child to the convulsions.

These are four cases in infants with definitely lower levels of calcium than normal and with clinical signs suggestive of tetany. In three cases the serum calcium was so low that tetany was undoubtedly the diagnosis. The symptoms in the first two cases were noticed at three and four days of age, respectively, and in Case 3, at one month. In the first case, in which the mother's diet was controlled, there was no known deficiency. The mother's blood calcium and phosphorus contents were normal. In the other cases we have no record of the mother's diet or blood chemistry.

Examination revealed no evidence of edema or unusual weight gain such as has been reported by some authors.

The serum calcium level in all was definitely below the normal level. The phosphorus content in Case 3 was raised but unfortunately not estimated in the other cases.

Calcium gluconate controlled the convulsions in three cases. In Cases 1 and 3 this was temporary at first so that the injection had to be repeated. Calcium chloride controlled the convulsions in Case 2 and was given to all the others after the initial injection. The third patient apparently died in a spasm, as death occurred after feeding.

Shannon[1] has reported a series of cases of edema of the newborn with tetany-like symptoms and signs. These patients responded to injection of calcium chloride and parathormone therapy. There were no serum calcium determinations made. McGavran[2] reported a typical case of tetany with recovery in a thirty-six-hour-old infant who was treated with calcium chloride. The serum calcium content was not determined.

Tisdall[3] in an analysis of 119 cases of tetany found one at seven weeks of age, two at eight weeks, and one at ten weeks.

Scott and Usher[4] in an analysis of twenty-one cases of tetany found the age incidence to be from two to fourteen months. Convulsions and positive electrical reactions were found in some with the serum calcium above 8 mg. per 100 c.c.

Powers[5] reported a case in a five-week-old infant with symptoms suggestive of tetany and a serum calcium level of 5.93 mg. per 100 c.c. In this patient the convulsions were unilateral. Maslow[6] reported five cases with lowered serum calcium and increased phosphorus contents in infants with ages varying from eighteen days to two months. The lowest calcium determination in this series was 4.7 mg. Small[7] reported symptoms observed at eight days and a serum calcium content of 5.6 mg. per 100 c.c. There are reports by others, some of which have considerably higher serum calcium values.[8, 9, 10, 11]

Most of the cases reported have been cured with calcium chloride or calcium gluconate. Some few have been treated with parathyroid extract. Infants in a few of the cases reported have died in spite of treatment.

It seems fairly well established from these case reports that tetany occurs in the newborn although most texts say that it does not occur in infants under two months of age.

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THE USE OF LACTIC ACID MILK IN THE PREVENTION OF SUMMER DIARRHEA

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IN URBAN life the mortality from diarrhea in infants under one year of age is greater than that of any other disease occurring in that age group. Although the neonatal mortality rate from New York City[1] has decreased from 113.4 per 1,000 live births in 1910 to 53.2 in 1933, it may be observed that 150 deaths from summer diarrhea among young infants were reported in the latter year. Thus it may be deduced that diarrhea in infants still constitutes a medical problem. It is the purpose of this report to show how this problem in its relation to summer diarrhea has been handled in a particular pediatric hospital.

Holt[2] in 1887 emphasized the importance of atmospheric heat as a causative factor in the production of diarrhea in infants. He pointed out that the disease occurred mostly in the months of July and August, that breast-fed infants were markedly less susceptible to its incidence, and that babies fed on condensed milk were unusually affected. He felt that antiseptics should be employed in the treatment, and he advised the salts of salicylic acid.[3] In 1889 Holt[4] again reviewed the subject and concluded that the elevated summer heat enhanced bacterial growth in milk and brought about intestinal toxemia. However, he emphasized that overfeeding was also a great danger. Previously, in 1884, Bajinsky[5] had demonstrated that humidity and rainfall played no part in the problem.

In 1903 Park and Holt[6] studied extensively the incidence of diarrheas among babies in the congested centers of New York City. They found a greater number of cases of diarrhea in the summer months and felt that, while there seemed to be many factors in the problem, the facts indicated that heat per se was the chief cause. The number of bacteria in the milk was an important secondary cause. They recommended widespread pasteurization of milk, more distribution of clean milk from health stations, and the maintenance of a low bacterial count in all milk supplies. In the succeeding decade, with these improvements, the mortality rate from summer diarrhea decreased sharply.

It should be noted, however, that all these observers warned that pasteurization and better hygienic distribution of the milk supply would not lessen the occurrence of this disease. That it persisted in spite of the removal of these sources of infection may be demonstrated by the following records from the New York Foundling Hospital.[7]

From the Service of Dr. John Giblin, New York Foundling Hospital.

TABLE I

SURVEY OF SUMMER DIARRHEA AT THE NEW YORK FOUNDLING HOSPITAL DURING THE MONTHS OF JULY AND AUGUST, 1910-1934

YEAR	NO. OF CASES	NO. OF CASES THAT BECAME MARASMIC	NO. OF DEATHS FROM SUMMER DIARRHEA	MORTALITY PER CENT
1910	357	137	232	65
1911	275	162	230	83
1912	258	108	170	65
1913	287	121	166	57
1914	129	69	69	53
1915	113	57	74	63
1916	165	91	105	63
1917	191	114	84	44
1918	97	61	57	58
1919	112	53	50	44
1920	51	10	31	60
1921	80	49	47	58
1922	23	11	10	43
1923	33	14	6	14
1924	26	23	16	60
1925	38	14	13	34
1926	29	9	19	65
1927	24	16	2	8
1928	39	21	22	56
1929	15	5	6	40
1930	48	16	14	29
1931	2	0	0	0
1932	1	0	0	0
1933	0	0	0	0
1934	0	0	0	0

During this time period, as shown by the accompanying charts, the average census in the hospital and in boarding homes under the control of the hospital totaled 3,000 children. The sharp decrease in the curve of incidence (Chart 1) during the years 1913 to 1920 may be explained by the fact that the milk laboratory had been modernized in the previous few years. The original milk laboratory of the hospital had been opened in 1897.[8] It was not until 1910 that modern equipment was installed.

It will be observed that during the decade from 1921 to 1931 numerous cases appeared, and the death rate was maintained (Chart 2). Moreover, the number of cases that reached the marasmic stage was very high. Because of these facts, it was felt that preventive measures were to be taken to wipe out the future occurrence of these cases.

The method of prevention was based, first, on the admonition of Holt, who urged underfeeding of children in summer; and second, on the successful method of treating marasmic babies that had been suggested by Marriott.[9] The latter had pointed out that the marasmic infant not only showed evidence of generalized atrophy and a decreased volume flow of blood with low protein content in the plasma, but also a diminished acidity in the gastric contents. He advocated the use of lactic acid milk for this type of baby. With it, he was able to increase the stomach acidity, to debufferize the milk, and to prevent intestinal intoxication. As

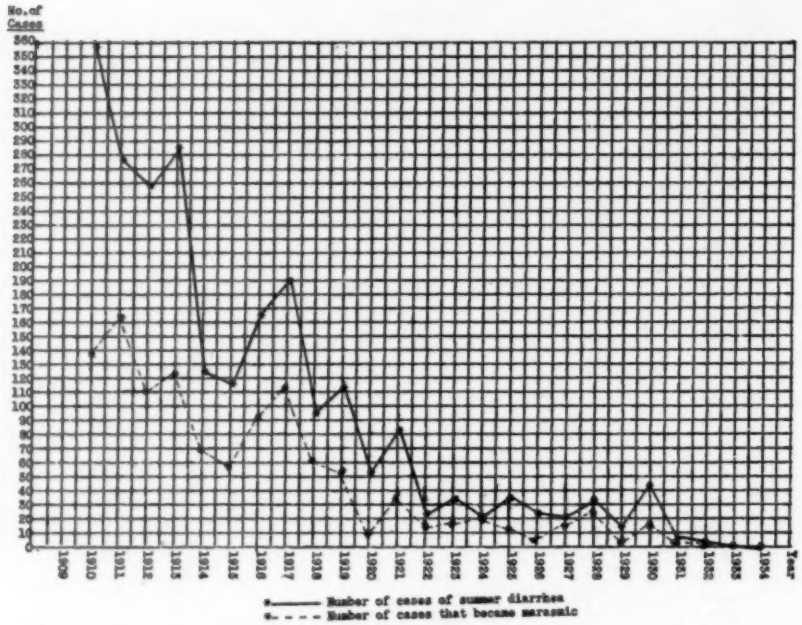

Chart 1.—Incidence of summer diarrhea at New York Foundling Hospital during months of July and August, 1910-1934.

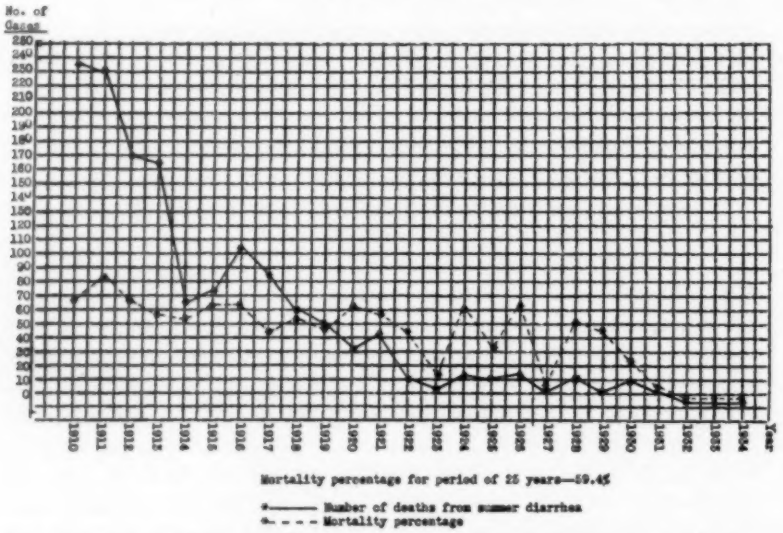

Chart 2.—Mortality from summer diarrhea at New York Foundling Hospital during months of July and August, 1910-1934.

a result, he reported a decreased mortality for marasmic infants from 78 per cent in 1919 to 26 per cent in 1923.[10]

In 1931 the feeding service at the New York Foundling Hospital employed a powdered lactic acid milk* in feeding its infants instead of using the customary whole milk mixtures. This powder in a dilution of 1 to 8 with water gave the percentage composition of whole milk with 0.3 per cent added lactic acid. Added carbohydrate was limited so that the total carbohydrate content did not exceed 7 per cent. During the summer months all the infants were somewhat underfed and the caloric value of the mixture employed was kept under 50 calories per pound of body weight.

During the summers of the last four years, 1931 to 1934, 403 infants were fed this lactic acid milk mixture. These infants were under six months of age and suffered generally from malnutrition. In this group no case of summer diarrhea occurred. None of these children became marasmic or died. The three cases of summer diarrhea reported in 1931 and 1932 were in infants who had been fed on whole milk mixtures (Chart 1).

SUMMARY

1. The incidence and mortality rate of summer diarrhea at the New York Foundling Hospital during the past twenty-five years (1910-1934) was reviewed.

2. It was noted that there was a persistence in the number of cases of summer diarrhea despite an adequate clean milk supply with a low bacterial count.

3. Because of the high percentage of marasmic cases resulting from summer diarrhea, powdered whole lactic acid milk mixtures containing only a total carbohydrate content of 7 per cent, 0.3 per cent lactic acid, and a caloric value of less than 50 calories per pound of body weight were fed to 403 infants during the summer months of 1931 to 1934. These infants were malnourished and were under six months of age.

4. Summer diarrhea did not occur among the 403 infants who were fed this type of lactic acid milk mixture.

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*Mead Johnson's powdered whole lactic acid milk No. 2.

AN EVALUATION OF SPLENECTOMY IN THE TREATMENT OF SICKLE-CELL ANEMIA

The Late Results of Two Cases so Treated With a Summary of the Present Condition of All Reported Splenectomized Patients

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INTEREST in sickle-cell anemia, first described as a clinical entity by Herrick[15] in 1910, has been considerably stimulated during recent years as is evidenced by the rapidly increasing literature on this subject. The disease is not rare and is encountered fairly often in any general hospital if the possibility of its occurrence is constantly borne in mind. Although sickle-cell anemia has not yet received the recognition which it deserves, it is a matter of practical importance to surgeons and pediatrists. Its varied manifestations often lead to mistakes in diagnosis, especially in conditions associated with abdominal and joint symptoms. The clinical, pathologic, and mendelian features of the disorder have been adequately discussed, notably by Anderson and Ware[1] and others.[6, 10, 11, 12, 17] Treatment, however, still remains a debatable subject, especially the efficacy of splenectomy. Only this phase of the subject is considered in this report.

At certain stages very large spleens have been noted in a considerable proportion of cases. This splenomegaly, coupled with the well-recognized hemolysis featuring the disease, led to the hope that a new clinical entity had come to light in which splenectomy might prove of as dramatic value as has been demonstrated in certain other types of anemia associated with splenomegaly.

The disease in severe form entails chronic invalidism and a very short expectation of life, and therefore any procedure offering reasonable hope of relief seems justified. The results of splenectomy have been somewhat encouraging, but the number of cases in which this procedure has been employed is small, and few data have appeared in the literature concerning the later results in cases so treated.

The purpose of this paper is to present two cases* of sickle-cell anemia with follow-up notes extending over a period of seven and five years after splenectomy and to summarize the present status of reported splenectomized cases, with the hope of contributing to a sounder evaluation of this procedure.

*The first of these cases was the basis for a preliminary report five years ago which occasioned a number of inquiries as to the advisability of splenectomy in selected cases of sickle-cell anemia.[20]

CASE 1.—Negro boy, four years old, showed marked anemia with great enlargement of spleen. There was no improvement on palliative treatment or transfusion at the end of five months. After splenectomy there was immediate improvement. At the end of seven years his condition was good.

E. F. was admitted to the Children's Ward of the Roosevelt Hospital, service of Dr. Philip Van Ingen, July 15, 1927. Two years before, at the age of two years, he was admitted to the New York Nursery and Child's Hospital with a one-year history of intermittent attacks of headache, fever, drowsiness, vomiting after meals, and generalized abdominal pain. General glandular enlargement, moderate secondary anemia, and a large, hard spleen were recorded. On admission to Roosevelt Hospital there was a greatly enlarged spleen, slight enlargement of the liver, and a hemoglobin of 12 per cent, with 950,000 red blood cells. No sickling was noted at this time. After five months' stay in the hospital, despite several transfusions, little change for the better could be observed; the spleen had reached the crest of the ilium, and, although the diagnosis was still uncertain, it was felt that splenectomy was justified.

The spleen was removed by Dr. James I. Russell on Dec. 12, 1927. It weighed 630 gm. and microscopically showed congestion and fibrosis only, but in the same sections Dr. Martha Wollstein, of the Babies Hospital, found sickle cells in a splenic sinus. One month after operation the hemoglobin content was 61 per cent with 3,300,000 red blood cells. The child's general appearance was good. Nine months after splenectomy he was readmitted to the hospital with an interval history of continuous fever and irregular attacks of abdominal pain. The child was undernourished but appeared lively and apparently comfortable. A blood count at this time showed a hemoglobin content of 58 per cent, and red blood cells numbered 3,800,000. Later follow-up on this case is as follows:

Oct. 1, 1931: Hemoglobin, 50 per cent; R.B.C., 3,240,000
Feb. 18, 1932: Hemoglobin, 45 per cent; R.B.C., 2,650,000
Sept. 29, 1932: Hemoglobin, 50 per cent
Feb. 15, 1933: Hemoglobin, 55 per cent; R.B.C., 3,440,000; icteric index, 16.3; sedimentation time, 30; van den Bergh test, negative.
Aug. 29, 1934: Hemoglobin, 46 per cent, R.B.C., 2,930,000; W.B.C., 9,600; polymorphs, 55 per cent; lymphocytes, 24 per cent; marked anisocytosis and poikilocytosis and many sickle cells. General condition about the same; child active; growth normal.

CASE 2.—Negro girl, aged five years, showed profound anemia with striking sickle-cell trait. There was no improvement after seven weeks with palliative treatment and transfusion. Splenectomy revealed a very large spleen. Her condition was excellent for one year; then she developed rheumatic heart disease with advanced valvular pathology. Three and one-half years after splenectomy, anemia was much less marked than before operation, but without change in sickling tendency.

J. R. was admitted to the Children's Ward of the Roosevelt Hospital, service of Dr. Philip Van Ingen, July 20, 1929, because of "bulging" of the upper abdomen. For four months prior to admission she had been treated with "worm medicine" by a druggist, and for two months previously the mother noted that the child's eyes were "greenish" and that she had lost weight despite excellent appetite and regularity of the bowels. There was no pain or other subjective complaint.

Delivery had occurred at full term and was normal. With the exception of an illness at one year, diagnosed as pneumonia, previous history was negative. Family history revealed that one sister was stillborn and four brothers died in infancy.

Physical examination on admission showed a bright, active negro girl, normally developed but undernourished. There was definite scleral jaundice. A few firm,

pea-sized, movable, nontender lymph nodes were felt in the neck and axillae. The left upper quadrant of the abdomen was bulging with a large mass (obviously the spleen) extending below the level of the left anterior superior iliac spine. The liver edge was felt one inch below the costal margin.

Laboratory Findings.—On five occasions the red blood cell count averaged 1,650,000, and the hemoglobin content 35 per cent. The white blood count and the differential count were essentially normal. The icterix index was 18 on admission. The van den Bergh test showed a positive delayed direct reaction. Wassermann reaction was negative; urinalysis and blood chemistry, normal. The fragility test showed that hemolysis began at 0.40 NaCl dilution and was completed at 0.24.

Course.—Three weeks after admission, a transfusion of 125 c.c. of citrated blood was given. This was followed by a rise in the red blood cell count to 2,100,000, the hemoglobin remaining the same. After splenectomy was decided upon, a preoperative transfusion of 250 c.c. citrated blood was given. Red blood cells the following day numbered 2,200,000 and hemoglobin, 40 per cent.

On Sept. 11, 1929, the spleen was removed without difficulty by Dr. Kirby Dwight. It weighed 655 gm. and measured 20 cm. by 13 cm. It was firm in consistency, deep purple in color, and the surface was "mildly irregular." The capsule was thin. The microscopic picture showed a general obliteration of the normal architecture. All vascular spaces were engorged with blood. There was some increase in fibrous tissue stroma.

Following splenectomy, there was a striking rise in the number of red blood cells, reaching 4,570,000 in three weeks, the hemoglobin content rising only to 50 per cent. The icteric index rapidly returned to normal, reaching 9 on the nineteenth day following operation. The fragility of the red blood cells remained the same.

The postoperative course was marked by a prolonged, irregular temperature rise. Clinical and x-ray evidence supported the diagnosis of bronchopneumonia. Convalescence was very slow, but the child was discharged in excellent condition on the one-hundred and third day.

The later follow-up on this case is as follows:

Dec. 12, 1929: (three months after operation). Condition excellent.

Sept. 10, 1930: (one year postoperative). Home visit (Social Service: "Child doing very well."

Dec. 4, 1930: Liver enlarged, ascites.

May 11,1931: Readmitted to hospital. Diagnosis: chronic cardiovalvular disease, mitral stenosis and insufficiency. Cardiac hypertrophy and dilatation. Ascites. Discharged July 24, 1931.

Oct. 1, 1931: Hemoglobin 57 per cent; R.B.C., 3,570,000; W.B.C., 11,040; polymorphs, 30 per cent; lymphocytes, 65 per cent; large monocytes, 4 per cent; many sickle forms.

Apr. 7, 1932: Doing badly. Liver large. Ascites.

Sept. 6, 1932: Readmitted to hospital. Bronchopneumonia. Advanced rheumatic heart disease. R.B.C., 1,040,000 to 1,380,000 and hemoglobin 25 per cent to 35 per cent.

Oct. 18, 1932: Hemoglobin 60 per cent; R.B.C., 3,910,000.

Feb. 15, 1933: Hemoglobin, 50 per cent; R.B.C., 3,160,000; W.B.C., 10,950; polymorphs, 74 per cent; lymphocytes, 24 per cent; large monocytes, 2 per cent. Sedimentation time, 40; van den Bergh test, normal; icteric index, 5.6.

Feb. 5, 1934: Readmitted to hospital. Hemoglobin, 59 per cent; R.B.C., 3,580,000; icteric index, 16.70; active rheumatic disease. Discharged Mar. 28, 1934, child going to West Indies.

COMMENT

It has been our feeling that both of these children have been benefited by splenectomy. The spleen was in each case enormous (630 and 655 gm.), the children being only four and five years old, respectively, at the time of operation. It has now been seven and five years since the splenectomies. As usual, the sickling tendency has persisted, and both children have continued to show moderate, variable anemia. However, the immediate improvement in the blood picture was remarkable in each case.

The boy (Case 1) has remained clinically well—enjoying apparently normal growth and vigor and freedom from abdominal or joint pains. It is to be remembered that for more than two years before splenectomy he had been taken from one clinic to another, as a very ill infant, and that antianemic treatment with transfusions had failed to check his progressive downhill course.

In the case of the girl (Case 2) an advanced degree of rheumatic heart disease has entered the picture, a frequent complication in sickle-cell anemia. She has continued to be moderately anemic, with exacerbations always accompanying the respiratory infections to which she is susceptible. It is probable that the splenectomy has not materially altered the basic course of the disease in this case. The phenomenal improvement which followed operation was not sustained, but, in our opinion, she is probably better off today than she would have been if splenectomy had not been performed.

We have attempted to obtain follow-up opinions on all reported cases of splenectomy in sickle-cell anemia and are indebted to the authors quoted in the following résumé for their cooperation in furnishing recent data on their cases.*

The patient whom Hahn and Gillespie[13] reported early in 1927 has continued to enjoy good health during the eight years since operation. Although he is somewhat "small for his age," he exhibits normal health and vigor. Hemolytic crises do not occur.[14]

Mitchell,[3] in commenting on the case reported by his collaborators and himself[2] in 1927 states that no recent information about the patient has been obtained but that "our impression was that splenectomy has done no particular good."

Cooley's[7] patient, splenectomized more than eight years ago, has progressed satisfactorily, and the blood picture has continued to improve.[9] There have been no abdominal or joint pains. The removal of chronically infected tonsils has somewhat complicated the evaluation of the relation

*An additional report of splenectomy in sickle-cell anemia in a one-year-old child has recently appeared in THE JOURNAL OF PEDIATRICS (November, 1934). Cooke and Mack state that at the end of two and one-half months neither the anemia nor the sickling had been changed materially.

of splenectomy to the improvement in her general condition. The impression, however, is that splenectomy in this case has been of benefit.

Subsequently a second similar patient of Cooley's was splenectomized, and a three-year follow-up found the blood picture unchanged although the joint and abdominal pains had not returned.[9] In a recent article Cooley[8] concludes that "the average degree and progress of the anemia is little affected but that improvement may be expected in regard to two troublesome symptoms, hemolytic crises, seldom so severe here as in hemolytic icterus, and the crises of abdominal pain, which are frequently due to splenic thrombosis." He believes that "justification for the operation is, in most cases, doubtful, though there does seem to be good reason for it when abdominal crises are frequent and troublesome."

Bothe[4] reported a case before the Philadelphia Academy of Surgery in which splenectomy had been performed in the case of a negro infant following a long trial of conservative treatment. The result after one year was encouraging. In discussing this case Dr. George Müller recalled an octoroon boy who was splenectomized for sickle-cell anemia in 1926 (and reported by Stewart[18] in 1927). He was studied in 1931, five years postoperatively, and found to be growing normally, perfectly well clinically but still markedly anemic. The spleen, in this case, had become much smaller during the long period of observation before operation, and it is doubtful if the splenectomy has had any important influence on the progress of the disease.

It must be reemphasized that the spleen in sickle-cell anemia tends ultimately to become small; in short, the patient eventually splenectomizes himself. There are autopsy records of phenomenally small spleens,[5, 10, 17] and on one occasion the spleen was so small as to be undiscovered at the time of attempted splenectomy.[6] We have, in this paper, been considering particularly the cases in which very large spleens are a prominent factor, occurring usually in small children.

CONCLUSIONS

1. Splenectomy, as a therapeutic measure in sickle-cell anemia, is not as definitely indicated as in certain other anemias associated with splenomegaly.

2. If the spleen is very large, splenectomy is of benefit and offers more hope than any other form of treatment.

3. The sickling trait persists after splenectomy.

4. The striking postoperative improvement in the blood picture is not sustained, but the patients continue to be generally more comfortable, more normal, and less susceptible to the usual complications which characterize the disease.

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ENCEPHALITIS IN CHILDREN

Some Etiologic and Therapeutic Considerations

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ENCEPHALITIS in children not infrequently leaves marked behavior problems in its train. Whether the subject is limited to the character changes following epidemic encephalitis, those following some of the acute infections of childhood, or encephalitis following brain injury, it matters little. Our larger cities have many examples of these difficult children, with their restlessness, irritability, tantrums, overaffectivity, and delinquencies. They represent an important community problem; it has been unsatisfactory or impossible to take care of them in their own or foster homes, pediatric wards, reform schools, penal institutions, or the ordinary wards of hospitals for mental diseases.

Excellent work in the study and treatment of such children has been done at King's Park in New York,[1] and in the special units organized under the supervision of the London County Council.[2] A special school for the study, management, and treatment of these conditions has been part of the Pennsylvania Hospital, in Philadelphia, for about ten years. Several reports have been made[3] on that work. In this school, cases with marked neurologic disabilities have not been accepted. We have concentrated on behavior disorders following encephalitis and have eliminated cases in which the parkinsonian syndrome has developed. The results have been encouraging. The great majority of children have been brought to the level of satisfactory adjustment at the hospital school, while approximately one-third have been able to return home and live satisfactorily.

Various plans have been tried at the school. At the start there was a fairly rigid hospital regime. Graduate nurses were in charge. The children attended to their studies under a special teacher. After school the children returned to the supervision of nurses. Special emergencies were treated with packs, sedative baths, isolation, and drugs. The psychiatrists followed usual psychiatric methods of interview, discussion, suggestion, and persuasion. Gradually, the psychiatrists developed more intensive methods of interview and treatment. The children's stories, phantasies, dreams, and drawings were used, not only to afford them emotional release, but also to acquire clearer understanding of the unconscious forces at work in these children.

Then came a period in which the regime was very informal. A matron was in charge. There were as few restrictions as possible. The chil-

dren were allowed considerable freedom. Some attended public schools outside the hospital, and some were allowed to go out from the hospital and around the neighborhood, as normal children do at home. This worked well for a number of children. One child, especially difficult, temperamentally negativistic, retaliating usually with bites, scratches, and kicks, did remarkably well. Her family, however, disapproved of such freedom, removed her from the school, and tried rigid discipline at home. She became unmanageable, and shortly had to be sent to the state hospital, where she has to live in complete isolation. For the majority, however, this regime did not work out satisfactorily. Our next step has been to place the children under the single control of a teacher. The staff is responsible to her. There is a definite but moderate daily routine. Individual modifications are frequent, and infringements are not punished unless they interfere with the demands of the group. Packs, drugs, and sedative baths are no longer used. There are several nurses in the organization, two teachers, a housekeeper, several assistants, and a divinity student who lives with the group of children. This personnel has acquired a certain degree of psychiatric understanding and has therefore taken over some of the duties formerly devolving on the psychiatrists. One physician has charge of the physical health of the group and has one or two cases for psychotherapy. The rest of the psychotherapy is done by psychiatrists or child guidance specialists, who have nothing whatsoever to do with the living arrangements and problems that arise in school or dormitory. The children go to these physicians several times a week for conferences. Although there are conferences between all the personnel to pool observations and suggestions, it has been found distinctly advisable to have the physicians who carry out the therapeutic work take no part in the daily management of the children. It makes for a freer relationship between child and physician if the latter is not considered as a person in authority. The psychiatrist is, therefore, better able to help the children work out their problems objectively and independently of the difficulties that arise when the therapeutist is also doctor for physical health, adviser to the personnel in urgent matters, and referee in daily disputes. Five psychiatrists are working with eighteen or twenty children. Different methods are used —play technic, child analysis, or relationship therapy. There is thus a growing opportunity to test the efficiency of different methods of approach. As time has gone on, therapy has become highly individualized, and more intensive psychotherapy has been practiced. With teachers, assistants, divinity students, in immediate charge, and therapy following chiefly along psychologic lines, it is clear that our treatment is not medical in the narrow sense of that term. We do insist, however, that the ultimate decisions made in conference be made by psychiatrists, that is,

by physicans trained in general medicine and neurology, as well as in psychiatry. Organic foundations and the investigation of physical factors therefore are not neglected.

With this background, let us consider some of the problems that encephalitis opens up, some fruitful lines of research, and therapy.

There is reason for optimism. Apparently hopeless cases have recovered. The impossibly aggressive have acquired control. Antisocial behavior has been modified and become adjusted to society. Difficult eroticism has been wholesomely modified.

In our opinion, the behavior problems of encephalitis cannot be adequately considered merely as problems *of organic pathology.* They are also problems *of social pathology.* And we do not mean this merely in the sense that social maladjustment removes these children from society and brings them to the school. We mean they are problems in social pathology etiologically and dynamically. Therefore, they must be of interest to social workers and teachers. We cannot understand these children fully by considering them as suffering from organic brain disease. As a matter of fact, the brain disease underlying these behavior disorders is not definitely known. We may speculate, but even leading neuropathologists have not, to my knowledge, had the opportunity of examining brains of children who have suffered only from postencephalitic behavior disorders. Therefore, where there are manifest problems of a definite concrete nature to be studied, it is better to work on these, rather than to speculate on the unknown. As a matter of fact, we must always remember that organic brain lesions do not completely explain even paresis or senile psychoses. Why can some people stand the brain changes of arteriosclerosis and senility, while others cannot? It is said that one of the most remarkable physicians of the country had the most advanced cerebral arteriosclerosis. Yet his personality organization withstood this assault of nature, and he did not become psychotic. We suspect that the type of personality organization has something to do with one's resistance to mental imbalance. Why can some people grow old gracefully, while others cannot? What makes the difference even in senile psychoses between the irascible, negativistic, difficult patient and the cooperative, pleasant, childish patient? Personally, we believe this is a question of psychology and personality development in addition to nerve cell degeneration.

A common etiology for all cases of encephalitis, even in the epidemic form, has not been established. Whether the condition is associated with influenza[4] and its bacillus, with a neurotropic streptococcus, or with a filtrable virus is not definitely known. However, the filtrable virus seems generally to be regarded as the most probable causative agent at the present time. The well-known, though poorly understood, association of encephalitis with some of the "virus" diseases of childhood[5] possibly

supports this view. Cerebral trauma produces mental conditions similar to those found in encephalitis, and it has been suggested[6] that there is a relation between birth trauma and encephalitis in children.

Our belief is that there is an encephalitic psychologic syndrome, as it were, just as there is a toxic infectious syndrome, which is nonspecific, in the sense that identical character changes and behavior disorders can appear as a result of measles, mumps, cerebral trauma, or encephalitis. Neither the infectious nor traumatic agent forms the whole explanation of the condition. Nor does organic pathology explain the characteristic behavior disorders and the psychologic disturbances. Endocrine studies in our clinic have not proved helpful. The usual clinical laboratory studies show results which are within normal limits. These include calcium determinations, which hypothetically might have been supposed to have been disturbed with the excessive restlessness and irritability.[7] Biochemical studies, then, at present are not helpful.

Sociogenic factors, however, are very important. The environmental and family relationships have seemed very significant. They give many more leads for study and investigation at present than do endocrinologic, biochemical, or neuropathologic studies. This is especially important, therefore, for doctors, teachers, and social workers to recognize.

Further, endogenous factors of the personality are important. The personality tendencies formed on the basis of past experience are of inestimable importance in considering the reactions of these children after encephalitis. How has this child been trained? How does the training enable the child to meet the stress of infection or organic brain disease? These considerations remove these phenomena from the purely biologic sphere. They extend encephalitic behavior disorders into the realm of psychology and sociology. Apparently a multiplicity of causes leads to the instability of postencephalitic behavior disturbances.

As there is no need to narrow or simplify our etiologic considerations, so is it wise not to limit our therapeutic endeavors. We cannot stop with medicines.[8] Our use of medicines has been confined largely to emergencies. Prolonged drug therapy with us has not been encouraging. There have been reports on the successful use of bulbocapnine. We have had no experience with this drug, but our conception of the etiology of this disease does not lead us to expect much beyond palliative or temporary effects. In addition to measures improving the general health of the individual, which may, of course, include medicine, our therapy must consider personality trends, as well as environmental factors, both past and present. These we firmly believe must have important consideration in any adequate therapy. Social workers and teachers can throw much light on these problems. Psychoanalysis, interpretative treatment, relationship therapy, environmental change, and reeducation with habit training, all have their place.

There seems to us a distinct danger in overemphasizing organic considerations. For doctors, it relieves their consciences and eliminates further study. It breeds a complacent but pessimistic outlook. For parents, it relieves individual responsibility, which is distinctly harmful when psychologic factors are of importance in the dynamics of the condition. Encephalitis is an interesting disease because it results sometimes in character changes or behavior disorders, and at other times in neuroses[9] or psychoses.[10] Occasionally there is overlapping of all of these pictures. It is important in postencephalitic character changes, just as it is in neuroses and some psychoses, to consider psychogenesis and sociogenesis, as well as somatogenesis.

The problem of the therapy of the encephalitic personality always extends in its implications far beyond encephalitis itself. Doctors mistake precipitating for final causes, and this attitude blocks research, limits therapy needlessly, and encourages often a neurasthenic attitude toward health. Each case is a piece of research work from the psychologic point of view, requiring as much time as the investigation of many cases in general medicine or neurology. It is of research value for psychopathology to observe developmental patterns, to recognize how they have been modified by the organic insults of encephalitis, and then to record the new reaction of the traumatized personality to ordinary sociologic stresses and extraordinary environmental difficulties.

Physicians are not the only ones capable of doing this. It is not sensible to limit this work to practicing physicians. Teachers, social workers, and nurses (visiting nurses, too) can make contributions of value (under psychiatric supervision or guidance) on the basis of careful observation.

Let us present three illustrations of the type of approach and therapy we have been talking about. They have all been serious problems. Two are in the community, adjusting themselves well. One is still in the school, but making definite progress.

B. R. G. was normal until she was six. Then she suffered a head injury, followed by coma and convulsions. It was thought she would die. Her spinal fluid pressure was increased. There were 125 cells (monocytes, 90 per cent) with a sterile culture. The diagnosis at the pediatric hospital was encephalitis. The skull roentgenogram was negative. When the coma disappeared, it was apparent that the child's mental state was much altered. She was retarded mentally, and had lost many of her capacities. She was incontinent, fed herself poorly, and had lost much of her vocabulary. Gradually these difficulties disappeared, but it was impossible for her to go to school because of her retardation and lack of cooperation. Although formerly well balanced emotionally, she now had fits of temper and was very excitable. At times she was unmanageable and ran away from home. She became very antagonistic to her mother and older sister and overaffectionate to her father. From time to time convulsions occurred, especially when she was disciplined by her mother. She became very dependent, and her mother indulged her to avoid the convulsions. It seemed wise to send her to our hospital school.

In this case there seemed to be purely an organic difficulty. But what further was observed? In the first place, after she came to the hospital, the convulsions lessened considerably, but when she visited home again, they increased in number. There was considerable anxiety, babyish behavior, and she made no progress at school for a long time although her intelligence quotient was 100.

In her conferences with psychiatrists, she showed a great deal of mother antagonism and affection for her father. Further, she had a considerable amount of guilt toward her father. The psychiatrist felt many of her aggressive tendencies toward her mother were converted into convulsions and sickness. She had a marked neurasthenic attitude. There was great concern for her health, so that little hurts and bruises brought her repeatedly to nurses and teachers for care, attention, and sympathy. She was very immature in this way. There were many other regressive tendencies. At times she suffered with a tendency that we are rarely bothered with, viz., overgoodness. It probably compensated for guilt feelings toward her father, and for her sexual phantasies. She was masochistic. One day she was found sitting quietly by herself, somewhat blue, with head down. When spoken to, she said that she wanted to die. There were teeth marks on her skin. She had bitten herself twice. When asked why, she replied that she was bad—"I have bad thoughts." Her behavior indicated immaturity, as we have stated, and she said that she did not want to grow up. The relation of regressive behavior and attitudes to the problem of convalescence is very important. Here we see in almost pure culture psychologic infantilism, the neurasthenic attitude to health, the disinclination to grow up, and the desire to remain a baby and be cared for. It is a partial manifestation of the will to illness, a refusal to give up the habits of being cared for which she experienced in her serious illness and which her mother continued through convalescence. Together with this, there was considerable exhibitionism and interest in sex. She preferred to play with boys and had much boy-envy in her nature. She liked to wear boy's clothes and to climb like boys, and even said that she was a little boy once.

There is not space to discuss the psychoanalytic material she has produced. However, her condition certainly cannot be understood without taking into consideration her degree of affection for her father, her guilt over this, the antagonism, and aggression toward her mother and sister, her envy and imitation of boys, her masochism and self-aggression, her immaturity and regressive tendencies, her neurasthenic attitude and concern over petty injuries, her preoccupation with sex phantasies, and the compulsion to be too good. These are psychologic and sociologic data. They are the moving forces in her personality. They are the things that have interfered with her scholastic work. With

an opportunity to release to her therapist some of these phantasies and forces and to act them out, she has improved. Her school work is better. The convulsions are much less frequent. There is more group cooperation. The concern for her health is diminished. She is more contented to be a girl. She has reached a stage where it is felt she could get along satisfactorily at home with a more intelligent mother.

R. E. E. had encephalitis following measles, at seven years of age. She was unconscious for three weeks. Her convalescence was very slow, and mental improvement came very gradually. She was melancholy and feared death if she cried a lot or was not feeling well. She had difficulty sleeping, was nervous and emotional, and cried easily. She would not obey. At school she showed lack of attention and concentration and would stare into space. She was thought to be abnormal. As time went on, she had difficulty playing with others, continued to be excitable, had frequent nausea, and showed a number of fears.

By considering and treating the psychologic and sociologic factors involved, this girl has been brought back to school, improved her scholastic standing, and entered into life as a happy child again. She had nervous fear. In her illness, there had been a constant apprehension lest she die. After her illness, she heard of this, and after such a threat to her life it was no wonder that sickness, death, and insecurity were clearly associated in her mind. Her mother was a frail person whose progressive illness continually reminded this little child of the uncertainty of life. Unfortunately, the mother had told the child that only bad people were afraid of death. The child feared death and consequently thought she must have been bad in some way which she was not aware of. Numerous little misunderstandings like this can add to the insecurity of children's lives. They can be cleared up if we learn about them, by presenting them with the facts of reality. But things like this children often find difficult to convey to their parents.

She had been encouraged to do a great deal of horseback riding because it was thought to be splendid exercise for her. But she disliked it intensely and was afraid although she never acknowledged her fear to her parents. The basis of the fear was threefold. The riding master continually urged her to jump, thinking thus to develop courage and overcome her timidity. The dogs that followed the horses often nipped at their legs and excited them. Finally, she had actually fallen off and not mentioned it to the family. When we relieved her of living up to the demands of her parents in regard to riding, it was a great relief and released much energy that could go into constructive channels. . . . These are remarkably simple things to do, but often in our search for the complex, we forget that there are simple things (like water and sunshine) that make for health.

Her social relations were not satisfactory. The mother of a girl she admired much had rather frowned on her daughter's playing with the patient. It got back to the patient that her friend's mother said she had been seriously ill and might have "spells" at any time. Of course, this was a source of anxiety to the patient until the mistake was corrected. Then the patient had a problem with her brother much younger than she. The parents had neglected to have playmates of her own age come after school and over week-ends to play with her. She was left to amuse herself with her younger brother. This led to a harmful identification and she became more immature. This was helped by the simple procedure of the mother's inviting playmates to the house, which was a great aid in making the child turn toward maturity and develop self-confidence.

A very complicating factor was the relation of the father and mother, and the father's attitude toward the young boy and the patient. The mother was not well

and not athletic. That was a disappointment to the father. The daughter, too, was not interested in athletics and was not strong. Unconsciously he centered his attention and interest on the boy, who was athletic. The patient felt this, and it made for her regressive identification and consequent lack of inclination for social contacts with children of her own age. When the father became aware of what he had been doing, he was able to correct this readily.

Coupled with the immaturity and social inadequacy, one aspect of her behavior appeared in some ways sophisticated. She talked of love and boys at school in a way that disturbed teachers and mothers. This was traced to the father's interest in a certain type of literature and movie; hence the patient's desire to cultivate his interests. The father's realization of this and his superb efforts to cultivate interests congenial and appropriate to his little girl helped tremendously.

The teacher was a great aid in bringing this child back to normality. The child had had reactions of nausea and even vomiting in the face of unpleasant or difficult things. (She had had feeding difficulties before the encephalitis, we had learned.) She was frequently kept from school on account of nausea. She got into the habit of calling for a patent preparation of soda that her parents used liberally for themselves. She had developed the habit of using this indigestion to get out of difficulties. She even used it to be sent home from school to get out of work. When it was explained to the teacher, she handled it most wisely. With calm sympathy and confident reassurance, she helped the child learn that her indigestion was not usually of great moment and that by handling it properly (and her thoughts and interests) she could overcome it and live more happily. With special tutoring and special attention to her problem of self-confidence, she got her stride in school work. And relieved in part of her emotional problems at home and in contact with her friends, she acquired stability and poise.

Again in this case, it seemed at first as if we were dealing merely with residual effects of organic brain disease. But by considering family relationships and the psychologic problems involved therein, by thinking of the father's thwarted ambitions for the daughter, and the father's own interests and diversions, by thinking of the mother's poor health, and the patient's relation to her brother and how that was a handicap in her social relations—by considering some of these things, and the psychologic foundation for her fears, we obtained a perspective of this child's difficulties that went far beyond merely organic or neurologic considerations. By considering these further factors, the child was brought back to mental health. Here it was with the cooperation of intelligent teachers and willing parents as much as with psychiatric help, that this result ensued.

P. A. C. at three years of age apparently had influenza. After this, she had to learn to walk again. She was restless, her face twitched, and she presented unusual movements of her eyes. Marked temper displays developed. Her nervousness increased when she went to school, and she was teased for it. She exhibited impulsive, apparently unmotivated screaming. She was afraid of the dark and often refused to come in from the street at night. When asked to help around home she refused. If reprimanded, she was vulgar and profane. There was frequent stealing and lying. There were minor sex experiences, and she could not be handled either at school or at home.

At the hospital school she was violent, kicked, screamed, and threatened to kill. She attacked others with anything at hand. Negativism was frequent, and she stared into space often. She had a low I. Q. in addition to her emotional handicap. For some time it was thought she would have to remain in a hospital for life.

Isolation helped a great deal for her tantrums. Private talks and reasoning worked much more satisfactorily with her than public reprimands. In this way we

obtained her confidence and cooperation. She felt our personal interest. We felt her aggressiveness was often an attempt to gain physically what she could not obtain by reasoning. Finally, it was really possible to help her sublimate this aggressiveness and domination into becoming the most efficient housekeeper and helper in the school. By dominating physical things and arranging them, she won the respect of her supervisors and doctors and made up for her feelings of inadequacy, particularly in the classroom. Reading de Schweinitz' *Growing Up* helped in removing much difficult erotic behavior. We discussed things with her frankly. As months rolled on, she began to improve. Her antagonism was met in a calm and friendly way. Her confidence was obtained, and she even cooperated in making reports on herself. Her ego was encouraged by the quality of her handwork and dramatic ability, capacities in which she surpassed others. She was encouraged to speak out her feelings, and we always tried to build up her self-respect by pointing out her genuine accomplishments. She had many fears and often morbid dreams. Frequently she dreamed her mother died or was a skeleton. She often dreamed of children being murdered by a man with a big knife. After a year, she went home with a fairly good understanding of herself. She had learned to cooperate and to be agreeable and helpful.

She told me an interesting story some days before she went home. While it still shows morbid patterns of thought, it did show a tendency to acknowledge guilt. There was confession and reconciliation, which displaced her former spirit of revolt and revenge.

> "A husband told his wife that he was going to put his son in the oven. He finally did and then told the police to search for his son, who was lost. The husband became sick, and before he died he called a priest and told him of his terrible deed. The priest told him to tell the police, which he did. The police thought of doing the same thing to him (putting him in the oven), but they didn't."

Whatever we may think of the theories of stories, phantasies, and dreams, certain things seem clear. There is something in each particular picture, whether dream or phantasy, which is interesting to the child, whether it is appealing or an object of fear. Somehow or other, it fits into the mental picture. We might say the mind (of which we know only a part) selects these images out of countless other possibilities, because they belong to or fit the total picture. A story, like the one we have just quoted, expresses emotions of cruelty, accident (sickness), remorse, confession, revenge, and reconciliation. It shows that the uncontrolled thinking of that child was playing with those images. It was a source of satisfaction that remorse and confession appeared, and that the story ended with reconciliation, rather than with revenge.

Aggression, cruelty, and retaliation were characteristics of our patient on entry. These impulses had been wholesomely influenced by her stay in the hospital, and there was reconciliation established between her impulses and the desires of the environment. In the hospital school she learned to make adjustment between herself and the social situation in which she found herself. It has been possible to transfer that adjustment to society at large.

I should like to add that this child has for five years held her place respectably in society. She is a young woman now and has helped her own family in difficult situations. After discharge, all was not smooth sailing with her. But with the help of the Big Sisters' Association and the Visiting Nurse, we were able to help her carry on. It was due in part to the cooperation of these agencies that her stability was maintained.

The three cases presented above in outline illustrate our conception of the nature of postencephalitic personality disorders. The total picture of etiologic factors (physical, traumatic agent, organic nervous system injury, sociogenic and endogenous personality factors) must all be considered to give the present responses (whether physical hyperkinesis or psychologic delinquencies or overaffect) their proper perspective. This is important, not only for postencephalitic behavior problems, but also for the proper consideration of certain neuroses and even some psychoses. The proper conception of causal factors influences our treatment. If we believe that the behavior disorders are completely due to organic disease,[8a] then naturally the conclusion follows that "attempts at psychotherapy are illogical and . . . futile." This is a view that is widespread in medicine and the community. It seems to us that our results indicate that such a conception does not apply to many cases and that pragmatically our psychotherapy, sociotherapy, and environmental therapy have worked. In our belief, causal notions and therapeutic considerations are closely related. In our conceptions, we send for and use teachers, social workers, visiting nurses, and other aids that the community affords us. It is important to get these two views contrasted, for one leads to fatalism and pessimism, while the other inspires us to therapeutic efforts and hopes that are not infrequently justified. Let me repeat that the considerations and conclusions discussed here extend far beyond the limits of encephalitic problems. They extend also to many problems of the neuroses, psychoses, and criminology in general.

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AMAUROTIC IDIOCY

(Infantile Type of Tay-Sachs' Disease)

Report of Another Case in an Infant of Non-Jewish Ancestry

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SINCE Sachs,[1] in describing amaurotic family idiocy, wrote that "the infantile form invariably occurs among Hebrews and among them only," occasional exceptions[2] to this statement have appeared in the literature. In all but two of the instances of Tay-Sachs' disease in infants of non-Jewish parentage the diagnosis depended on the presence of cherry-red spots in the ocular fundi and was not confirmed at autopsy. Greear[3] in 1932 reported an example of this condition in a female infant of Irish-Catholic and German-Lutheran ancestry, in which the clinical diagnosis was verified by postmortem examination. Schlesinger, Greenfield, and Stern[4] described in detail the clinical course and pathologic findings of a twenty-two-month-old English female, in whose family there was no history of Jewish intermarriage. In view of its rarity it would seem of value to report briefly a third proved case of the Tay-Sachs type of amaurotic family idiocy, which occurred in a gentile infant of pure Norwegian stock and presented a typical clinical course and histopathology.

CASE REPORT

M. L., a twenty-one-month-old white female, was admitted to the Children's Memorial Hospital on Apr. 4, 1934, because of gradually increasing apathy and listlessness.

The patient was the youngest of three children, two older brothers being in good health. Both parents were living and well. They were not consanguineous and came of pure, unadmixed Norwegian stock; the parents were certain that no Jewish blood had occurred within the four generations spanned by their respective memories. No previous members of the family had suffered from a similar disease although a maternal uncle, aged sixteen years, died of epilepsy with mental deterioration and another uncle, also on the maternal side, is at present confined because of schizophrenia.

The patient had been born at full term, after a normal labor. Her health and development were entirely normal for the first six months.

When she reached an age of six months, her parents noted a gradual change in her behavior. She was no longer interested in her surroundings. Slowly she became more listless; the mother believed that her muscles had meanwhile grown "stiff." After the first year she would not voluntarily move her arms or legs. She was unable to sit up or, apparently, to recognize her parents. It became necessary

From the Children's Memorial Hospital and the Otho S. A. Sprague Memorial Institute, Chicago, Ill.

to feed her by bottle because of what was thought to be difficulty in opening her mouth. Continued deterioration, striking weakness, and "flabbiness" marked the six months which preceded her admission. In the last two months of this period she lay without moving, crying or responding to her environment in any way. Vomiting, which was obstinate and frequently projectile, began six weeks before her entry into the hospital.

Physical Examination.—The patient was an emaciated white female infant who lay motionless and flaccid in a spread-eagle position, oblivious of the examiner. Her head was enlarged, with bulging anterior fontanel. There was no apparent visual perception. The ocular fundi were waxy pale with cherry-red spots present in each; the retinal arteries were narrowed. There was a marked hyperacusis. The corneal, palatal, and pharyngeal reflexes were diminished. An object placed on the lips caused sucking movements. Occasional twitchings were present in the face and upper extremities. All abdominal and deep reflexes were absent. The patient seemed to appreciate a pin prick, but a detailed examination of the sensory apparatus was impossible. All four limbs were markedly hypotonic, and the child could not hold up its head, sit, stand, or walk. No signs of meningeal irritation were present. The heart, lungs, and abdomen were essentially negative.

Laboratory Data.—The urine was negative. Blood: On admission the erythrocytes numbered 3,600,000; leucocytes, 9,200 (46 per cent polymorphonuclears, 54 per cent lymphocytes); no vacuoles; hemoglobin content, 45 per cent. On April 7, 1934, a lumbar puncture revealed a clear fluid with a pressure of 22 mg. of mercury, which rose on jugular compression; 4 lymphocytes per cubic millimeter were present. May 16, 1934: blood cholesterol, 210 mg.

Progress.—The course was steadily downhill. At times the deep reflexes could be elicited, but such occasions were rare and lasted for only short periods. Decerebrate rigidity was never present. The head showed no further enlargement, although its anterior fontanel bulged constantly, less so immediately after lumbar puncture. On June 25, a series of generalized convulsions occurred. They were unaccompanied by fever and did not recur, although from time to time there were convulsive twitchings of the face and extremities. Hyperacusis remained constantly present throughout the hospital stay. There were occasional bouts of fever; for most of these no cause could be ascertained, but some were due to mild infections of the upper respiratory tract. Although fed by gavage and proctoclysis, the infant became steadily more emaciated and died of weakness on July 23, 1934.

Postmortem.—The examination, begun sixteen hours after death, revealed the body of an extraordinarily emaciated female infant, weighing 5.1 kg. (normal 11.8 kg.) and measuring 81 cm. in length (normal 82.8 cm.). The head was symmetrically enlarged, measuring 49 cm. in circumference (normal 47.2 cm.). The anterior fontanel was open, 3 by 5 cm. The sagittal suture was separated. Four lower and four upper incisors were present.

The subcutaneous fat was almost entirely gone, and all the muscles showed a marked atrophy. The thoracic and abdominal viscera were pale but otherwise normal, except for their decreased size and weight.

The brain was large and hard to the touch.

Microscopic examination (for help with which I am indebted to Dr. George B. Hassin) revealed swollen disfigured ganglion cells throughout the entire central nervous system, cerebral cortex, cerebellum, midbrain, medulla, and spinal cord. Not only were the ganglion cells enlarged, but they were also, as a rule, devoid of dendrites and usually balloon shaped. The nucleus was displaced to the periphery, the cytoplasm honeycombed and filled with prelipoid, so-called hematoxylinophylic granules, which did not stain with scarlet red. These granules were seen only in frozen sections, mounted in glycerin, in the form of dark bluish granules (hematoxy-

lin) filling the entire cytoplasm. Glia nuclei or oligodendrogliocytes were very numerous and mixed with cytoplasmic astrocytes and fat granule bodies (gitter cells). Scarlet red stains revealed in the latter fat droplets which were not found in the ganglion cells. Nerve fibers were preserved for the most part, and the meninges were hyperplastic. The cerebral subarachnoid space contained numerous fibroblasts, polyblasts, fat granule bodies, and other less well-defined elements. No ganglion cells were found in the retinas.

SUMMARY

1. A case of amaurotic family idiocy in an infant of non-Jewish ancestry (at least four generations) is presented.

2. The classical clinical picture which the patient presented was confirmed postmortem by typical widespread ganglion cell changes and the presence of hematoxylinophilic granules, showing this to be an authentic example of the infantile type of Tay-Sachs.

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CACHEXIA HYPOPHYSEOPRIVA (SIMMONDS' DISEASE)

Report of a Case in an Adolescent Girl

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CACHEXIA hypophyseopriva, the clinical condition described first by Simmonds[1] in 1914, has attracted widespread interest among practitioners treating adults, but, according to the published reports, has not been noted frequently among children. Silver,[2] in his review of the subject in 1933, listed only one case as occurring before the age of twenty years. Since that time, however, we find three reports of this or a similar condition in childhood or adolescence. Prusener[3] cited an instance in a three-and-one-half-year-old child with stoppage of growth and cachexia and gave a complete report of the autopsy findings. Cervera, Folch and Benaiges[4] described a fifteen-year-old girl whose clinical picture seemed typical and who showed marked improvement with glandular therapy supplemented by stimulating doses of x-rays. Barr[5] observed a sixteen-year-old boy with growth stoppage, lack of sexual development, headache, and a calcium deposit in the center of the sella turcica. His patient, however, did not show a reduction in the basal metabolic rate.

The syndrome as usually described consists of progressive cachexia, premature aging, dental caries, low basal metabolic rate, and decrease in the size of the vital organs, splanchnomicria, and loss of pubic and axillary hair, libido, and sexual function. In those cases which have been examined post mortem, this condition has been associated with destruction of the anterior lobe of the pituitary gland.

The following case is reported because we feel that it illustrates the condition as it may occur in an adolescent girl and because it may increase our knowledge as to therapeutic possibilities.

N. C., a fifteen-year-old girl, was first seen on Nov. 3, 1933. She stated that she had lost about 30 pounds since the previous February. Questioning brought out the facts that she had been irritable during this period, had marked loss of appetite, intractable constipation, and that the menses, which had been entirely normal for three years, had ceased with a scanty flow in February, 1933.

The birth, developmental, and family histories were of no significance.

Previous illnesses included scarlet fever with catarrhal otitis media at the age of five years, measles at seven years, mumps, pertussis, and chickenpox later. She had had two attacks of influenza. In March, 1932, she suffered from bilateral, purulent otitis media complicated by bilateral mastoiditis and acute hemorrhagic nephritis. An uneventful recovery followed mastoidectomy on both sides. During the following summer she felt well, gained weight, and reentered school in September.

During the fall, she lost 4 pounds of weight but seemed to be in good health until January, 1933, when she had several attacks of coryza complicated by sinusitis.

From this time on she lost weight steadily and began to notice the symptoms noted above. Her maximum weight was 104 pounds.

Physical examination revealed a well-developed but emaciated white girl not acutely ill and intolerant of medical attention. Her weight was 74 pounds, height 63 inches, temperature 97.6° F., pulse 68, and respirations 22 per minute. The blood pressure was 104/70 mm. Hg. The general examination, aside from the cachexia, revealed only the scars from the previous mastoidectomies and some carious teeth. Pubic and axillary hair was present but rather scanty.

She was admitted to the Evanston Hospital where laboratory tests showed the following: urine qualitatively normal, a variation in specific gravity of from 1.007 to 1.020 in the Mosenthal test; an excretion of 90.1 per cent of phenolsulphonephthalein injected intravenously after seventy minutes; hemoglobin content of 78 per cent; erythrocyte count of 4,390,000 cells; and leucocyte count of 7,800 cells with a normal differential smear. The blood chemical examination revealed no appreciable deviation from normal, and the Wassermann and Kahn tests were negative. The

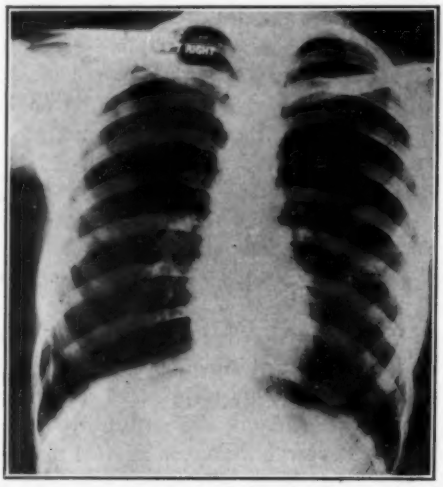

Fig. 1.—Roentgenogram showing small heart shadow.

basal metabolism tests showed rates of minus 25 and 28. Roentgen ray examination showed a duodenal dilatation in the third portion without demonstrable stasis, an exceedingly small heart shadow (Fig. 1) and a small sella turcica (Fig. 2).

By November 8, while she was at home and eating somewhat better, she gained ½ pound, but by November 11 she had dropped off 3 pounds more in spite of a high caloric diet taken fairly well. At this time, because of the low basal metabolic rate, 2 grains of desiccated thyroid extract were given daily. By December 4, she had lost another pound, and on December 13 she had lost ½ pound more. On December 27, she was readmitted to the Evanston Hospital having lost 6 pounds since her previous entrance. She had been active at home, but the anorexia had persisted, and she complained of acid eructations and gastric distress after meals. The physical examination was unchanged except for an increase in the emaciation. The blood pressure was 95/50 mm. Hg; the hemoglobin, 70 per cent; and the red blood cell count, 3,600,000. The glucose tolerance test gave values of 84.0 mg. fasting sugar, and 133.0 mg., 100.0 mg., and 90.0 mg., one, two, and three hours after the glucose meal. There was no glycosuria. The basal metabolic rate was minus 28

in spite of thyroid extract; the gastrointestinal roentgen ray examination was reported the same as before. The radiologist suggested a partial duodenal obstruction as the cause of the symptoms, but, after surgical consultation with Dr. Frederick Christopher, it was decided not to explore the abdomen.

The patient at this time was on a high caloric diet with adequate vitamins added and was also getting thyroid extract, 2 grains daily. This was stepped up to 3 grains daily. No improvement was noted. Whole anterior pituitary substance (antuitrin, Parke, Davis & Company) was then administered hypodermically, 1 c.c. daily in addition to the thyroid extract. There was no increase in weight, the child

Fig. 2.—Roentgenogram of skull showing normal or small sella turcica.

having lost to 64 pounds by this time. It was then decided to discontinue the thyroid extract and to increase the antuitrin dosage to 2 c.c. daily. Within twenty-four hours of this change, she began to gain from 1 to 1½ pounds daily. After regaining the weight she had lost in the hospital, she went home where the parents continued the hypodermic administrations. On March 3, 1934, she weighed 86.5 pounds. By April 23 she had gained to 89 pounds, and because there had been no menstruation, it was decided to give 1 c.c. each of the plain antuitrin and of antuitrin-S, the gonad-stimulating fraction. On May 18 she weighed 88 pounds, the antuitrin-S was discontinued, and the plain antuitrin maintained at 1 c.c. daily. On July 24 the weight was 84 pounds. During the summer the treatment was desultory due to

lack of contact with the parents, who would try to get along without the hypodermics for a while and then, seeing that she lost weight, would reinstitute therapy. She was not seen again until Dec. 1, 1934, when she weighed 91 pounds and looked extremely well. The parents were instructed to administer 1 c.c. daily of each type of antuitrin for two weeks of each month, which regime has been continued up to one month ago. She now weighs 101 pounds, has a basal metabolic rate of minus 18, and is attending high school regularly. Menstruation has not been reestablished as yet, but otherwise there is no apparent deviation from the normal in her daily existence. The appetite has been markedly improved ever since the antuitrin was given. Treatment now consists in 2 c.c. of antuitrin (plain) 10 days of each month. It is hoped that with further advance in the knowledge of endocrinology we may be able to reestablish menstruation.

COMMENT

We feel that a diagnosis of pituitary cachexia is justified in this instance because the patient presented most of the classical symptoms, loss of weight, anorexia, carious teeth, cessation of menses, low basal metabolic rate, and splanchnomicria. Her marked immediate response to pituitary therapy has confirmed this opinion. It was an interesting fact that no improvement was noted until the thyroid medication was discontinued which would make it appear that the reduction in metabolic rate was possibly due to a deficiency in other glands than the thyroid, possibly the suprarenals as well as the pituitary. It cannot be definitely stated that the pituitary damage was secondary to the severe mastoid infection, but the sequence of events is suggestive. It should be noted that this child had suffered from several purulent infections about the head prior to the cachectic symptoms.

Since the patient during the past year has been able to hold her weight and at times even to gain slightly while not receiving any treatment over a period of a few weeks, it seems possible that there may be some regeneration of anterior pituitary substance going on at present. Weinstein[6] suggests this possibility in his case report in which he points out that remissions and exacerbations may occur over a period of many years.

SUMMARY

An instance of pituitary cachexia occurring in a fifteen-year-old girl is reported.

Marked improvement in all symptoms except the cessation of menstruation accompanied hypodermic therapy with anterior pituitary extracts.

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FURTHER OBSERVATIONS ON THE USE OF ACETARSONE IN THE TREATMENT OF CONGENITAL SYPHILIS

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IN AUGUST, 1932, the writer, in collaboration with A. Abt,[1] reported on the treatment of twenty-two cases of congenital syphilis with acetarsone administered orally. The following year the writer[2] reported on fifty-four cases treated with acetarsone. With few exceptions these patients had received only one course of treatment with the drug.

In order to determine the value of acetarsone in the treatment of congenital syphilis in relation to the serologic reactions, clinical changes and benefits, effect on kidneys and blood, and complications, it was deemed necessary to continue the use of this drug over a longer period of time and in a sufficient number of cases.

This report deals with the use of acetarsone for a period of over three years in 65 cases of congenital syphilis. Twenty-one of these patients were infants under one year of age; 22 were children between one and six years of age; and 22 were children between six and twelve years of age.

Of the 65 children treated with acetarsone, 29 received three or more courses. Some received as many as eight courses of treatment.

EFFECT OF ACETARSONE ON BLOOD WASSERMANN AND KAHN REACTIONS

Infants Under One Year of Age. (Table I.)—The 21 infants under one year of age were treated orally with acetarsone by the dosage method of A. Bratusch-Marrain,[3] in which the amount of acetarsone in grams consumed during one course of nine weeks of treatment corresponds approximately to the weight of the infant in kilograms. For example, an infant weighing 6 kilograms would receive approximately 6 grams of acetarsone during one course of sixty-three days of treatment. According to the method of Tuscherer,[4] that same infant would receive 21 grams of the drug in forty-one days of treatment. By the method of Maxwell and Glaser,[5] he would receive 14 grams of acetarsone in forty-nine days of treatment (⅔ of Tuscherer's dose). This difference in the dosages is, in my opinion, a factor in the development of severe complications.

All of the 21 infants in this series had positive blood Wassermann and Kahn reactions at the beginning of treatment. Eleven of the infants received only one complete course of treatment. Two of the 11

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TABLE I

EFFECT OF ACETARSONE ON WASSERMANN AND KAHN REACTIONS OF THE BLOOD

(INFANTS UNDER ONE YEAR OF AGE)

CASE	AGE	SEX	BEFORE TREATMENT		AFTER TREATMENT													
					1ST COURSE		2ND COURSE		3RD COURSE		4TH COURSE		5TH COURSE		6TH COURSE		7TH COURSE	
			WASSERMANN	KAHN	WASSERMANN	KAHN	WASSERMANN	KAHN	WASSERMANN	KAHN	WASSERMANN	KAHN	WASSERMANN	KAHN	WASSERMANN	KAHN	WASSERMANN	KAHN
1	1 mo.	F	++++	++++	++++	++++												
2	1 mo.	F	++++	++++	Neg.	Neg.												
3	2 mo.	M	++++	++++	Neg.	Neg.												
4	2 mo.	M	++++	++++	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.								
5	2 mo.	M	++++	++++	Neg.	Neg.												
6	2 mo.	M	++++	++++	Neg.	Neg.												
7	6 wk.	M	++++	++++	Neg.	Neg.												
8	8 wk.	F	++++	++++	Neg.	Neg.												
9	10 wk.	M	++++	++++	++++	++++	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.						
10	10 wk.	M	++++	++++	Neg.	Neg.	Neg.	++	Neg.	Neg.	Neg.	Neg.						
11	3 mo.	M	++++	++++	Neg.	Neg.	Neg.	Neg.	Neg.	++++	Neg.	+++	Neg.	++	Neg.	Neg.		
12	4 mo.	M	++++	++++	Neg.	Neg.												
13	4 mo.	M	++++	++++	Neg.	Neg.												
14	4 mo.	F	++++	++++	Neg.	Neg.												
15	5 mo.	M	++++	++++	++	++++												
16	11 mo.	M	++++	++++	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.		
17	8 mo.	M	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++				
18	7 mo.	M	++++	++++	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.								
19	6 wk.	M	++++	++++	++++	++++	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.				
20	2 mo.	M	++++	++++	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
21	9 mo.	F	++++	++++	++++	++++	++++	++++										

infants showed positive Wassermann and Kahn reactions, and 9 showed negative Wassermann and Kahn reactions after treatment. One infant nine months old received two courses of treatment with no reversal of the Wassermann and Kahn reactions after treatment. Two infants received three courses of acetarsone therapy with a serologic reversal and have remained negative on three subsequent examinations six months apart without further treatment.

Ten-week-old twins were given four courses of therapy. After the first course of treatment one remained serologically positive but reversed after the second course, and the blood Wassermann and Kahn reactions have remained negative after the third and fourth courses of treatment. The other twin had a reversal of the Wassermann and Kahn reactions after the first course of treatment and has remained serologically negative.

Two infants received five courses of treatment. One, eight months old, has remained positive after each of the five courses. The other, six weeks of age, showed positive Wassermann and Kahn reactions after the first course of treatment, but reversed to negative after the second course, and has remained so after the subsequent three courses.

Two infants received six courses of treatment. One infant, three months old (Case 11), became negative after the first course of treatment and remained so after the second course. After the third course, however, the Kahn reaction changed from negative to four-plus, although the Wassermann reaction remained negative. The Kahn reaction was influenced by further treatment and became negative after the sixth course. This infant was subject to many upper respiratory infections, which may have played a rôle in the change of the Kahn reaction from negative to positive. The other, eleven months old (Case 16), showed negative Wassermann and Kahn reactions after each of the six courses of treatment with acetarsone which he received.

One infant received seven courses of treatment. The Wassermann and Kahn reactions became negative after the first course of acetarsone therapy and remained so after each succeeding course.

Of the 21 infants treated with from 1 to 7 courses of acetarsone, 4 remained serologically positive (19.4 per cent) and 17 became negative (80.6 per cent). Of these 4 infants who failed to become negative, 2 received only 1 course of treatment; 1 received 2 courses of treatment; and 1 received 5 courses of treatment.

Children Between One and Six Years of Age. (Table II.)—There were 22 children in this age group. Four received 1 course of treatment; 6 received 2 courses; 3 received 3 courses; 1 received 4 courses; 3 received 5 courses; 4 received 7 courses; and 1 received 8 courses of treatment with acetarsone. Twelve children in this group received 3 or more courses of acetarsone therapy.

Table II

Effect of Acetarsone on Wassermann and Kahn Reactions of the Blood

(Children One to Six Years of Age)

Case	Age	Sex	Before Treatment		After Treatment															
					1st course		2nd course		3rd course		4th course		5th course		6th course		7th course		8th course	
			Wassermann	Kahn	Wassermann	Kahn	Wassermann	Kahn	Wassermann	Kahn	Wassermann	Kahn	Wassermann	Kahn	Wassermann	Kahn	Wassermann	Kahn	Wassermann	Kahn
22	3 yr.	M	+++	++++	Neg.	++++	Neg.	+++	Neg.	++	Neg.	+	Neg.	Neg.						
23	3 yr.	M	++++	++	Neg.	++++	++	++++												
24	5 yr.	F	++++	++++	Neg.	Neg.														
25	2½ yr.	F	++++	++++	++++	+														
26	5 yr.	M	++++	++++	+++	+++	++++	++++												
27	4 yr.	F	++++	+++	++++	++	++++	+++												
28	4 yr.	M	++++	++++	Neg.	++++	++	+++	Neg.	++++	Neg.	Neg.	Neg.	Neg.	Neg.	++	Neg.	Neg.		
29	4 yr.	M	++++	++++	++++	++++	++	+++												
30	4 yr.	F	++++	++	++++	+++	++++	++++												
31	4½ yr.	F	Neg.	++++	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Two subsequent negative Wassermann and Kahn reactions									
32	5 yr.	M	++++	+++	++	++++	Neg.	++++	Neg.	++++	Neg.	++++	+++	++++	++	++	Neg.	+	Neg.	Neg.
33	4 yr.	M	++++	+++	++++	++++	++++	++++	++++	++++	++++	++++	++++	++++	++	++++	Neg.	++++		
34	6 yr.	M	++++	++	++++	+++	++++	+++	++++	+++	++++	++++	++++	+++	++++	+++	++++	++++		
35	14 mo.	M	++++	++++	Neg.	Neg.														
36	6 yr.	F	++++	++++	++++	+++	+++	+	++	++++	++++	++++								
37	18 mo.	M	++++	++++	++++	++++	Neg.	Neg.	Neg.	Neg.										
38	6 yr.	F	++++	+++	Neg.	++++	Neg.	++++												
39	6 yr.	F	++++	++++	++++	++++														
40	6 yr.	F	++++	++++	++++	++++	++++	++++	++++	++++	++++	++	++++	++++						
41	6 yr.	M	++++	++++	++++	++++	++++	++++	Neg.	++++	++++	++++	++++	++++						
42	6 yr.	M	+++	+++	Neg.	++	Neg.	++	Neg.	+++	Neg.	+++	Neg.	Neg.	Neg.	Neg.				
43	2½ yr.	F	+++	++++	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.										

All of these children, except 1 (Case 31), had positive Wassermann and Kahn reactions before treatment was commenced. Nine showed a reversal of the Wassermann and Kahn reactions (40.9 per cent), and 13 children remained positive (59.1 per cent). One child (Case 38) showed a negative Wassermann reaction after the first course of treatment and remained the same after the second course, but the Kahn reaction remained four-plus after both courses.

Further study of Table II shows that the longer the child is treated, the greater the chance of reversing the blood Wassermann and Kahn reactions (Cases 22, 28, 32, and 42).

Some of these children were very irregular in their attendance at the clinic, and all of these remained positive. Four received 2 courses of treatment, and 1 received 4 courses of treatment (Cases 27, 29, 30, 38, and 36).

Children Between Six and Twelve Years of Age. (Table III.)—There were 22 children in this age group. Eleven received only 1 course of treatment; 3 received 2 courses; 2 received 4 courses; 4 received 5 courses; 1 received 6 courses; and 1 received 7 courses.

In this age group, all had positive blood Wassermann and Kahn reactions before treatment was commenced. After treatment, 6 (27.3 per cent) showed a reversal of the Wassermann and Kahn reactions (Cases 52, 53, 58, 59, 60, and 62). Nine children (40.9 per cent) remained positive. (Cases 44, 45, 48, 49, 51, 56, 57, 64, and 65.)

Seven children in this group (31.8 per cent) after treatment showed a negative Wassermann reaction and a positive Kahn reaction or else showed a positive Wassermann reaction and a negative Kahn reaction. (Cases 46, 47, 50, 54, 55, 61, and 63.) If the above partial reversals are to be considered as positive, the percentage of children who failed to reverse serologically in this group will be 72.7, and the percentage of those who reversed 27.3.

The majority of the older children in this age group came to the clinic unattended by their parents. The social condition and the supervision at home were poor. Therefore, it is uncertain whether they received the acetarsone regularly and in the amounts ordered. This is an unfavorable factor in the administration of a drug when given orally over a long period of time, and has been suggested by some as an argument against the oral treatment of congenital syphilis. The results obtained serologically in these cases compare favorably with the results obtained by the older methods of treatment.

No attempt will be made to compare the above results with those of all of the other clinicians and investigators who have reported on the use of acetarsone in the oral treatment of congenital syphilis. The

TABLE III

EFFECT OF ACETARSONE ON WASSERMANN AND KAHN REACTIONS OF THE BLOOD

(CHILDREN SIX TO TWELVE YEARS OF AGE)

CASE	AGE (IN YR.)	SEX	BEFORE TREATMENT		AFTER TREATMENT													
					1ST COURSE		2ND COURSE		3RD COURSE		4TH COURSE		5TH COURSE		6TH COURSE		7TH COURSE	
			WASSERMANN	KAHN	WASSERMANN	KAHN	WASSERMANN	KAHN	WASSERMANN	KAHN	WASSERMANN	KAHN	WASSERMANN	KAHN	WASSERMANN	KAHN	WASSERMANN	KAHN
44	10	M	++++	++++	++++	++	++++	++	++++	++++	++++	++++						
45	7	M	++++	++++	++++	++++												
46	10	M	++++	++++	Neg.	++++	Neg.	++++										
47	8	M	++++	++++	++++	Neg.												
48	9	M	++++	++++	++++	++												
49	9	F	++++	++	++++	++	++++	++++	++++	++++	++++	+++	+++	+				
50	8	M	++++	++++	++++	++++	++++	++++	++	++++	Neg.	+++	Neg.	++				
51	10	M	++++	+++	++++	++++	++++	++++										
52	9	F	++++	++++	Neg.	Neg.	Neg.	++	Neg.	+++	Neg.	Neg.						
53	7	M	++	++++	Neg.	+++	Neg.	++	++++	++++	Neg.	++	Neg.	++	Neg.	Neg.		
54	7	M	++++	++++	++++	+++	++	+++	++++	++++	Neg.	+++	Neg.	++				
55	9	F	++++	Neg.	++++	++++	++++	++++	++++	++++	++++	++++	++	++++	++	++++	Neg.	++++
56	7	M	++++	++++	++++	++++	++++	++++										
57	7	M	+++	+++	++	++++												
58	7	M	++++	++++	Neg.	+++	Neg.	++++	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.				
59	8	M	++	++++	Neg.	Neg.												
60	7	F	+++	+++	Neg.	Neg.												
61	12	M	+++	++++	Neg.	+++												
62	9	M	++++	++++	Neg.	Neg.												
63	12	F	++	+++	Neg.	+++												
64	12	F	++++	++++	++++	++++												
65	11	F	++++	++++	++++	++++												

work of the German and French clinicians has been well reviewed in previous reports. Only a comparison with the results obtained by other American clinicians will be attempted.

In our first article[1] we reported on the treatment of twenty-two children with acetarsone. Six of these were infants under one year of age. Five of these infants (83.3 per cent) showed a reversal of the Wassermann and Kahn reactions after one course of treatment. In the older group of children, 8 (50 per cent) of the 16 reported became serologically negative, and 8 (50 per cent) remained positive.

Rosenbaum[6] in his first report states that all of the 9 infants under one year of age treated with acetarsone showed a reversal of the Wassermann and Kahn reactions (100 per cent). Of 6 children who were more than one year old when treatment was begun, serologic tests became negative in three cases (50 per cent) and remained positive in 3 cases (50 per cent).

Maxwell and Glaser[5] report the reversal of the Wassermann and Kahn reactions in all of 12 infants under one year of age treated orally with acetarsone. Nine of these infants received more than 2 courses of treatment. They also report on the treatment of 9 children over one year of age. Some of these children in the older group had additional treatment with bismuth and mercury, and yet in none of the 9 children treated with 1 to 3 courses of acetarsone was there a reversal of the Wassermann and Kahn reactions.

In a subsequent report the writer[2] treated 54 children with 1 to 2 courses of acetarsone. Fourteen of these children were under one year of age. The serologic tests in 10 of these infants became negative (71.4 per cent) after treatment, and in 4 they remained positive (28.6 per cent). In the older group of children between one and six years of age, in which there were 19 cases, a reversal of the serologic reactions occurred in 55 per cent of the cases. In the group of 21 children between six and twelve years of age, the serologic reactions became reversed in 47 per cent of the cases.

Coppolino[7] reports on the use of acetarsone in the treatment of congenital syphilis in 20 children. Ten were infants under one year of age. In this infant group 9 were between two and four weeks old, 1 was ten months old. Two of these 10 infants received 1 course of treatment; 4 received 2 courses; and 4 received 3 courses. At the end of the first course, the Wassermann and Kahn reactions became negative in 9 of the 10 infants (90 per cent). On the completion of the second course, all of the patients gave negative serologic reactions. In the older group of 10 children, 9 showed positive Wassermann and Kahn reactions, and 1 showed a negative Wassermann reaction but a four-plus Kahn reaction before treatment. Four patients received 1 course of treatment; 5 re-

ceived 2 courses; and 1 received 3 courses. The Wassermann and Kahn reactions became negative in only 2 instances (20 per cent) and remained unchanged in 8 cases (80 per cent).

In comparison with bismuth therapy, Coppolino states that, of the infants treated with bismuth, 50 per cent became serologically negative after the first course, and all became negative at the end of the second course. In an older group of children, the Wassermann reaction was reversed in 37.5 per cent of those treated with bismuth, in comparison with 20 per cent treated with acetarsone.

Rambar[8] treated 32 premature infants with acetarsone, 8 of whom had the drug alone; 7 had mercury in combination with acetarsone; and the remaining 17 had previous courses of mercury and sulpharsphenamine. The blood Wassermann and Kahn reactions were negative after one course of therapy in all infants treated with acetarsone alone, or with mercury in combination with acetarsone, and all have remained negative.

Rosenbaum[9] in a later article reports that 3 out of 34 infants (9 per cent) still had positive Wassermann and Kahn reactions after one year of treatment with acetarsone. In 91 per cent of the infants treated, the blood Wassermann and Kahn reactions became negative. In 20 of these cases, reversal followed after the first course of treatment; in 7 it followed the second course; and in 4 it followed the third course.

In a similar age group of 29 cases treated by the older methods, Rosenbaum reports that 18, or 62 per cent, were positive after one year of treatment. This compares with 9 per cent in those treated with acetarsone.

In an older age group of 28 cases he states that 16, or about 57 per cent, showed reversal following treatment with acetarsone, as compared with 20 per cent of a group of 48 cases treated by older methods.

Yampolsky,[10] in collaboration with Cathcart and Smith, reports 16 cases of congenital syphilis treated with acetarsone. Four children were under one year of age. All of the 4 infants had positive Wassermann and Kahn reactions before treatment. After treatment, 1 infant (*Case 3*) showed a complete reversal of the Wassermann and Kahn reactions. In one infant the Wassermann and Kahn reactions of the blood were not obtained. In another, the blood was influenced to two-plus, and in one it remained four-plus. Of the remaining 12 cases in the older age group, 2 were Wassermann-fast before treatment. After treatment the table shows that in 1 (*Case 13*) the Wassermann and Kahn reactions were not obtained, and in 1 (*Case 5*) no record as to the blood Wassermann and Kahn reactions is noted. Of this older group then, of 10 children, in whom the blood Wassermann and Kahn tests were obtained after treatment, 4 children (40 per cent) showed a reversal of the

Wassermann and Kahn reactions, and 6 children (60 per cent) remained positive. Of the 2 Wassermann-fast cases, 1 remained four-plus, and 1 reversed to negative after treatment. In their group of cases, the result obtained in the older group is better than that in the infant group. However, the small number of patients in the infant group must be considered as a factor in the results obtained.

Therefore, with the exception of Yampolsky and his coworkers, all of the American investigators reporting on the use of acetarsone in the oral treatment of congenital syphilis have had excellent results clinically and serologically in infants under one year of age. The percentage of reversals of the blood Wassermann and Kahn reactions varied from 71 per cent to 100 per cent. In the group of 21 infants reported in this paper, the blood Wassermann and Kahn reactions became negative in 80.6 per cent.

In the older age group, the results obtained are not so good. The percentage of reversals of the blood Wassermann and Kahn reactions varied from 0 in Maxwell and Glaser's cases to 57 in Rosenbaum's cases. In the series reported here, 40.9 per cent of the children in the age group between one and six years showed a reversal of the Wassermann and Kahn reactions, and in the age group between six and twelve years, 27.3 per cent.

In comparison with other methods of treatment, Coppolino obtained slightly better results with bismuth therapy than with acetarsone therapy. Rosenbaum obtained much more favorable results with acetarsone therapy than with older methods of treatment.

It is the opinion of the writer that better results will be obtained in the older child if acetarsone therapy is combined with bismuth therapy. The use of bismuth injections during the six-week rest period between courses with acetarsone would no doubt increase the percentage of reversals of the blood Wassermann and Kahn reactions. This method is now being used at our clinic, and the results obtained will be reported at a future date.

EFFECT OF ACETARSONE THERAPY ON BONE LESIONS

In a previous report[1] we made the following statement: "Roentgenologically, the osseous changes were completely healed after one course of treatment. . . . The bone changes as noted by the x-ray were completely healed after one course of treatment. . . . The cases with periostitis and those showing rarefaction and evidence of destructive changes in the bones were completely healed after one course of treatment."

The following cases showed bone lesions clinically and roentgenologically. The roentgen ray findings are given in detail.

The great majority of these roentgenograms were studied and read by Dr. James T. Case, head of the department of roentgenology at Northwestern University Medical School.

CASE 1.—This month-old infant was brought to the clinic for treatment at very irregular intervals. From July, 1931, to March, 1932, she had a total of ten weeks of treatment.

Roentgenogram 1.—Evidence of thickening of the periosteum of the radius and ulna. The fibula and tibia also showed periosteal involvement.

Roentgenogram 2.—(After four weeks of irregular treatment.) The films of July 9 showed a break in the continuity of the bone at the right tibia, which might be a fracture. Also, there was an irregular area of rarefaction about the lowermost portion of the right fibula. In the lower one-third of the right radius there was an area of rarefaction, extending about two-thirds across the width of the bone. The left radius and ulna were also involved. A break in continuity, certainly resembling a fracture, extended across the left ulna, about 1 cm. above the epiphysis. There was also an area across the lower third of the left radius. The bones of the leg showed a rarefied, gouged-out area in the lower third of the tibia, which had a general appearance of the area seen in the upper extremity.

Roentgenogram 3.—(After ten weeks of irregular treatment.) The appearances which were present upon the previous examinations had entirely disappeared. The spontaneous fractures seen previously had all healed, leaving no trace of the former existence. The extremities of the diaphysis of all of the bones showed no destructive lesions, and there was no evidence of periosteal involvement at this time. This case was regarded as one of unusual appearance produced by congenital syphilis.

Roentgenogram 4.—"From the x-ray standpoint alone, I would not recognize that this was a case of congenital lues."

CASE 3.—*Roentgenogram 1.*—Rarefaction of all bones of the extremities, especially the tibia. Epiphyseal margins were sharp, showing none of the fraying so characteristic of scurvy. Periosteal involvement was visible around the distal end of the right humerus and to a more pronounced degree involved the right ulna, radius, and entire shaft of the left tibia.

Roentgenogram 2.—(Taken four days later.) Marked degree of rarefaction of all the bones and numerous large and smaller defects involving practically every bone were present but were especially evident at the anterior aspect of the proximal ends of both tibiae, both ulnae, and the distal end of the radius. Similar defects involved practically every one of the phalanges and metacarpals. A high degree of periostitis involved the entire length of the shaft of both tibiae, both ulnae, and both radii. A slight periosteal involvement was visible along the shaft of the metacarpals of the left hand. Soft tissue swelling of the hand was very pronounced.

Roentgenogram 3.—(After four weeks of treatment, but ten months after the last roentgenogram.) "We find no evidence of congenital lues in any of the bones."

CASE 5.—*Roentgenogram 1.*—Areas of excavation and translucency were seen at the ends of the long bones on the diaphyseal side of the epiphyseal line. Thickening of the periosteum was noted in the long bones.

Roentgenogram 2.—(After one course of treatment.) Complete healing noted of all the bones. No evidence of congenital syphilis visible.

CASE 6.—*Roentgenogram 1.*—Thickening of the periosteum was noted for the full length of all the bones.

Roentgenogram 2.—(After one course of treatment.) Right ulna and radius showed no evidence of raised or thickened periosteum. Periostitis of the right tibia and femur remained similar to the previous examination.

CASE 9.—*Roentgenogram 1.*—There was a periosteal thickening of all of the bones shown in the examination. The periosteal thickening was greatest on the anterior surface of the tibia. The fibula was the least involved of any of the bones. The appearance of the ends of all of the bones was unusual where they joined the epiphysis, but it was hardly the characteristic appearance seen with congenital syphilis. "However, I presume that the appearance must be due to luetic involvement."

Roentgenogram 2.—(After one course of treatment.) The pathologic lesions seen at the former examination had entirely disappeared. No periosteal thickening or raising of the periosteum was seen at this time.

CASE 10.—*Roentgenogram 1.*—There was a periosteal involvement of all of the bones, the anterior surface of the tibia and femur being most involved.

Roentgenogram 2.—(After one course of treatment.) Marked improvement. The raising and thickening of the periosteum had entirely disappeared in all of the bones.

CASE 14.—*Roentgenogram 1.*—Evidence was noted of thickening and raising of the periosteum in all of the bones of the right leg and forearm. At the distal extremity of the right tibia, there was an irregularity of the epiphyseal line.

Roentgenogram 2.—(Six weeks later—treatment interrupted on account of a mild arsenical dermatitis.) Thickening and raising of the periosteum was still evident in the bones of the right forearm and right leg, also in the left forearm and in some of the metacarpals. Very little change since the last examination.

Roentgenogram 3.—(After the completion of nine weeks of treatment.) Marked improvement. No evidence of periosteal involvement.

CASE 18.—*Roentgenogram 1.*—At the lateral margin of the distal extremity of the radius on the right side, there was a punched-out area which certainly indicated syphilis. Thickening of the periosteum was noted in the humerus.

Roentgenogram 2.—(After one course of treatment.) Marked improvement. Area in lower end of the right radius, which showed evidence of destructive changes, had been completely filled in at this time, and no evidence of thickening of the periosteum was noted at any point.

CASE 21.—*Roentgenogram 1.*—"There was an apparent raising of the periosteum of the femur. This was seen to a lesser extent in the periosteum of the humerus. There was a little flattening of the epiphyseal end of the diaphysis."

Roentgenogram 2.—(After one course of treatment.) No evidence of any periostitis noted.

CASE 30.—*Roentgenogram 1.*—The right ulna and the right radius showed irregular periosteal thickenings on their mesial borders. There was a large defect in the region of the radial tuberosity and a similar defect at the juncture of the lower and middle third of the ulna on its mesial border. These changes are indicative of syphilis.

Roentgenogram 2.—(After first course of treatment.) Negative findings in the right arm and the right leg.

CASE 35.—*Roentgenogram 1.*—Slight bowing of tibia of right leg and a distinct thickening of the periosteum on the convex side, one of the stigmas of congenital syphilis, was noted.

Roentgenogram 2.—(After one course of treatment.) X-ray pictures negative for pathologic lesions.

CASE 36.—*Roentgenogram 1.*—Definite thickening of the shaft of the tibia was noted. The cortex of the tibia was considerably thickened in the middle, also the right radius. Very suggestive of syphilis.

Roentgenogram 2.—(After one course of treatment.) X-ray plates are negative.

CASE 40.—*Roentgenogram 1.*—Thickening of cortex of bone along the anterior portion of tibia and beginning formation of saber tibia were noted. Epiphyses were jagged as if bitten out. Definite signs of bone syphilis, especially in the epiphysis of tibia.

Roentgenogram 2.—(After one course of treatment.) No evidence of any pathologic lesions.

CASE 50.—*Roentgenogram 1.*—The lateral view of the long bones of the right leg showed a moderate anterior curvature with a slight degree of thickening of the cortex anteriorly and posteriorly. There were slight defects in the upper posterior angle of the tibia in the lateral view and in the anterior angle on the anteroposterior view. The findings were suggestive of syphilis.

Roentgenogram 2.—(After one course of treatment.) Findings were negative.

CASES 2, 8, 13, AND 16.—*First roentgenograms* showed periostitis of the long bones. *Second roentgenograms* (after one course of treatment) showed complete healing of all the bones involved.

Eighteen children of the 65 here reported showed syphilitic bone lesions roentgenologically. Thirteen of these were infants under one year of age. In only two instances (Cases 6 and 14) were there incomplete healing after one course of treatment with acetarsone. In Case 14 complete healing of the bone lesions took place after the second course of treatment.

An infant two months old (Case 3) showed marked syphilitic bone lesions roentgenologically before treatment with acetarsone was commenced. This infant received only four weeks of irregular treatment. When he was returned to the clinic several months later for further treatment, the roentgenograms taken at that time showed complete healing of the bone lesions. Similar results were noted in Case 1.

These are not unusual findings, as other clinicians and investigators have shown that syphilitic bone lesions, especially in infants, may disappear of their own accord even without treatment.

Michajloff, Plotkina and Bobowitsch[11] report on the involvement of the osseous system in congenital syphilis in small children by roentgenologic findings. After examining 150 children between the ages of two weeks and five years, they state: "In regard to the course of the osteochondritis (in infants), we may say that, according to the findings of other investigators and of the authors, it may disappear of its own accord. It re-

sponds just as rapidly to specific treatment. After combined therapy or after two courses of a continuous treatment, residual symptoms will only be found in exceptional cases. Osteoperiostitis (in older children) persists for one and a half years without any treatment. To specific medication osteoperiostitis reacts in a much more stubborn manner than osteochondritis. The former disease requires a minimum of two or three courses of treatment."

Pehu,[12] in discussing infantile syphilis, states that syphilitic bone lesions can be determined by radiographs in the first month of life. However, they diminish and disappear at the sixth or ninth month, because they present a tendency toward spontaneous cure without leaving any traces.

Friedman[13] reports five infants under one year of age treated with acetarsone and evaluates the effect of the drug on bone lesions. Roentgenograms of the long bones were taken before treatment and at varying intervals during treatment. These demonstrated the prompt healing of the syphilitic lesions of the bones.

Mettel[14] reports on four older children who showed severe bone lesions roentgenologically, and clinically had discharging sinuses. Under acetarsone therapy there was rapid clinical and roentgenologic healing.

Rosenbaum[6] states that hydrarthrosis and bone lesions responded very well with acetarsone therapy.

Scherber[15] reports a case of an eight-year-old boy with interstitial keratitis and inflammation of the knee joints on both sides. Thirty tablets (0.25 gm. each) of acetarsone were given in two courses. Complete healing of the knee joints resulted.

Nedelmann[16] reports on the roentgenologic improvement of severe bone processes after treatment with acetarsone.

Yampolsky[10] and his coworkers, however, commenting on our earlier results, state: "These are exceptionally good results, but they do not coincide with our findings. Among 11 cases, we had only one in which there was no definite evidence of syphilitic involvement following treatment. Two patients showed marked improvement but not complete healing. . . . Altogether the results were disappointing. One of the patients had two courses of treatment, but roentgenograms exhibited a progressive syphilitic lesion. Roentgenologic examination does not show that acetarsone alone has a material effect on changes in the lesions of the bone."

Examination of *Table 5* in their report reveals that, of the 16 cases reported, 13 showed bone lesions before treatment. Of these 13 cases, 2 (*Cases 13 and 15*) are not reported roentgenologically after treatment; in 1 (*Case 8*), roentgenograms were not obtained; and in 1 (*Case 2*), no notation is present at all. In other words, in 4 cases of the 13, no roentgenograms are reported after treatment.

Of the remaining 9 cases, 3 are infants under one year of age. Roentgenograms of the bones of 2 of these infants showed improvement after treatment, and in 1 there is no change. In my opinion, these results are not bad. In all probability another course of treatment with acetarsone would have promoted complete healing.

Of the other 6 cases, 1 (*Case 6*) showed complete healing and 1 (*Case 7*) showed some improvement. The 4 other cases showed no changes roentgenologically after treatment.

Their table was studied carefully since the results recorded there conflict somewhat with their conclusions. Although their results are certainly not so good as those of the writer, or that of Friedman, Mettel, and many others, nevertheless, they do not seem to be so bad as they state. Of their 9 cases, improvement was noted in 3 and complete healing in 1. Of the remaining 5 cases, in which no healing was noted in the roentgenograms, the ages of these patients (eleven months, ten years, five years, three years, and eleven years, respectively) are of significance. With the exception of the eleven-month-old infant, the others are in the older group in which osteoperiostitis is persistent and in which more than one or two courses of treatment are necessary to promote healing. It does not matter whether combined methods of treatment are used or whether acetarsone alone is used. This point is brought out by the writings of Michajloff, Pehu, and many others.

EFFECT OF ACETARSONE THERAPY ON THE URINE

Urine specimens of each patient treated were examined weekly. In the great majority of infants and children treated, some pathologic urinary findings were noted at one time or another. The majority showed only an occasional trace of albumin, but there were some which showed albumin to the extent of one-plus, two-plus, or three-plus. A number of children also showed at times occasional hyaline or granular casts, and several also showed a few red blood cells.

It was only in those patients whose urine showed two-plus or more albumin, with or without casts or red blood cells, that treatment was suspended for a week or two until the urine became normal; then treatment was again started. No permanent kidney damage has been noted in any of our patients treated with acetarsone although a great number of them have received many courses of treatment. It is the opinion of the writer that the method of dosage followed and the six-week rest period between courses play an important part in the prevention of serious kidney damage.

EFFECT OF ACETARSONE THERAPY ON THE BLOOD

Blood counts of each patient were made before treatment was begun and after each course thereafter. In cases of marked anemia, blood studies were made at other times during the courses of treatment.

Acetarsone promotes improvement in the blood picture especially in the infants showing marked anemia. The hemoglobin values and the number of red cells rise.

Eosinophilia, frequently found in congenital syphilis, was a prominent finding in the majority of the children treated.

COMPLICATIONS

Although a large group of children were treated and many of the older children have received as many as six to eight courses of acetarsone over a period of from two to three years, no serious complications have been noted.

The method of dosage employed and the rest period between courses of treatment play a rôle of great importance in the prevention of severe complications. Whether the Wassermann reaction is positive or not, a rest period should follow a course of treatment to allow proper elimination of the arsenic. This belief is held by Erich Mueller[19] and others.

Nedelmann[16] states that the elimination of arsenic in the feces and the urine is now being investigated. Thus far, it was found that a healthy nursing infant eliminated more than 50 per cent of the arsenic absorbed with a course of one tablet (0.25 gm.) of acetarsone daily for ten days. Within the following ten days, without acetarsone, all the rest of the arsenic, with the exception of a small portion, was eliminated. Whether it is entirely resorbed to become effective or whether the arsenic takes effect within the organism before being eliminated cannot yet be decided.

J. Glaser[17] reports two cases of myelitis due to acetarsone poisoning, with one death. One infant, three weeks old, weighing 8½ pounds (about 4 kg.), was treated with acetarsone according to the dosage of Tuscherer.[4] When the infant was eight weeks old and weighed 10 pounds and 9 ounces (about 5 kg.), he had received 7.5 gm. of acetarsone. During five weeks of treatment, therefore, this infant had received 7.5 gm. of acetarsone. If this same infant were treated according to the method of Bratusch-Marrain,[3] he would have received only 2 gm. of acetarsone during that period of time.

The other infant reported by Glaser was started on acetarsone therapy when 29 days old. At that time she weighed 8 pounds and 2 ounces (about 4 kg.). Twenty-three days later her weight was only 8 pounds and 9 ounces, and it was noted that she occasionally vomited following medication. However, since she looked well although she was gaining poorly, the acetarsone was continued. The following week, when she was sixty days old, diarrhea developed. In thirty-four days the baby received 7.68 gm. of acetarsone. The infant died. Had this infant been treated by the Bratusch-Marrain method, she would have received in the length of time treated a maximum of 2.5 gm. of acetarsone.

It is questionable whether the severe complications described by Glaser could have been prevented, no matter what method of dosage was used. It is well known that some infants and children are hypersensitive to arsenic in any form and that even small doses may prove fatal. However, it is the opinion of the writer and the experience of others that nothing is to be gained by huge doses of arsenic in the treatment of congenital syphilis. In fact, large doses of acetarsone are contraindicated.

Oppenheim,[15] who has had the greatest experience of all in the use of acetarsone in the treatment of congenital syphilis, states that giant doses are superfluous and advises the use of small doses.

It has been the policy of the writer to cease all treatment at the first evidence of any upset of any kind in the patient. The parents are instructed to stop the acetarsone and to return to the clinic at once at the first sign of any disturbance in the child, whether it be vomiting, diarrhea, eruptions on the skin, or fever. These precautions, the method of dosage used, and the rest period have proved successful so far, in the prevention of severe complications. The occurrence of minor upsets, which clear up when the drug is withheld for a short period of time, has been commented upon in a previous communication.[2]

CLINICAL RESULTS

The clinical results obtained in this series have been excellent. Under acetarsone therapy the infants and children thrive, their colors improve, their appetites improve, and usually there is a definite and sometimes marked gain in weight. In infants the clinical symptoms disappear in a short time. Late manifestations, such as interstitial keratitis, are also definitely benefited by acetarsone therapy, although the length of time to promote complete healing is prolonged.

SUMMARY

Sixty-five cases of congenital syphilis, treated with acetarsone over a period of several years, are reported.

Twenty-one infants were under one year of age; 22 children were between one and six years of age; and 22 children were between six and twelve years of age.

In the infant group the Wassermann and Kahn reactions became negative in 80.6 per cent of the cases; in the group between one and six years of age the Wassermann and Kahn reactions became negative in 40.9 per cent; and in the older group between six and twelve years of age the Wassermann and Kahn reactions became negative in 27.3 per cent.

Acetarsone brought about healing of the bone lesions in 16 out of 18 cases after one course of treatment, as shown by roentgenograms. In 2 cases the bones healed after two courses of treatment.

No serious urinary changes occurred in the series. Albuminuria and the presence of red blood cells and casts were noted at times. These findings, however, cleared up on suspending treatment for one or two weeks, or they disappeared during the rest period between courses.

Secondary anemia noted in a number of the children treated improved after one or more courses of acetarsone. Eosinophilia was a persistent finding.

No serious complications occurred in the series.

CONCLUSIONS

Acetarsone is the ideal drug for the oral treatment of congenital syphilis in the infant.

In the older child acetarsone is also of great value. It is probable, however, that better results may be obtained serologically if bismuth is given to the child during the six-week rest period between courses of acetarsone.

The ideal method of dosage is that of Bratusch-Marrain, the one followed in this series of cases. No serious complications were noted.

The children treated must be kept under strict and close supervision, and the parents must be instructed to stop the drug at the first evidence of any untoward effects.

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AN ENCEPHALOGRAPHY CHAIR FOR CHILDREN

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ENCEPHALOGRAPHY is at present a widely used diagnostic procedure in both adults and children. The term is commonly used to describe the removal of cerebrospinal fluid by lumbar puncture in the sitting position and the replacement of this fluid by air. The latter rises to replace the fluid in the spaces about the cerebral structures and furnishes sufficient contrast in density with these structures to permit their delineation by roentgenography. Several satisfactory methods of air injection are in current use.[1-5, 7-10] All require that the patient remain in the sitting position with the lumbar needle in situ for varying periods of time. A number of encephalography chairs for adults have been devised,[5, 6, 12, 13] and these greatly facilitate the procedure for either conscious or anesthetized patients. In general, however, these chairs are reported as not being sufficiently adjustable to accommodate the extremes of size and body configuration met with in children. As encephalography in children is usually carried out under general anesthesia, it is customary to have the patient's dead weight entirely supported in the sitting position by a nurse or assistant. Inasmuch as the procedure may require up to an hour's time, the convenience of some mechanical means of support is easily appreciated. To meet this need in a hospital dealing entirely with neurologic and psychiatric disorders of childhood, an encephalography chair was devised which has proved satisfactory in clinical use.

The design was based upon the following major requirements: The inert patient must be firmly supported in the sitting position. The lower back must be frequently exposed to facilitate lumbar puncture and the attachment of any auxiliary apparatus. It is often desirable that the head remain free for tilting or other manipulation. The patient's respiration and circulation must not be embarrassed. At times it is advantageous to have one or both arms free for observing blood pressures or for intravenous procedures. All restraints must be capable of instant release in case of emergency.

These requirements are all met in the chair shown in the accompanying illustrations. For the sake of brevity and clarity only the essential features will be described, as the details of construction may well be altered to suit individual preference.

To maintain a sitting posture, the conventional fundamentals of chair construction are roughly followed. To allow free exposure of the lumbar region, the chair is made without a back. No head support has been

From the Emma Pendleton Bradley Home.

provided, and during air injection the patient's head is easily manipulated by a nurse. Respiration and circulation are left unimpaired by padded shoulder straps (Fig. 1), which leave the arms entirely free. All supporting straps are secured by toothed pressure-buckles (such as are used by mail carriers), which are capable of instant release, having no tongue to be disengaged.

The spine is kept erect by firmly binding the child's shoulder girdle to a vertically sliding back support, which is freely adjustable to the patient's sitting height. Security is provided by using two canvas shoulder straps, each attached at one end near the center of the back

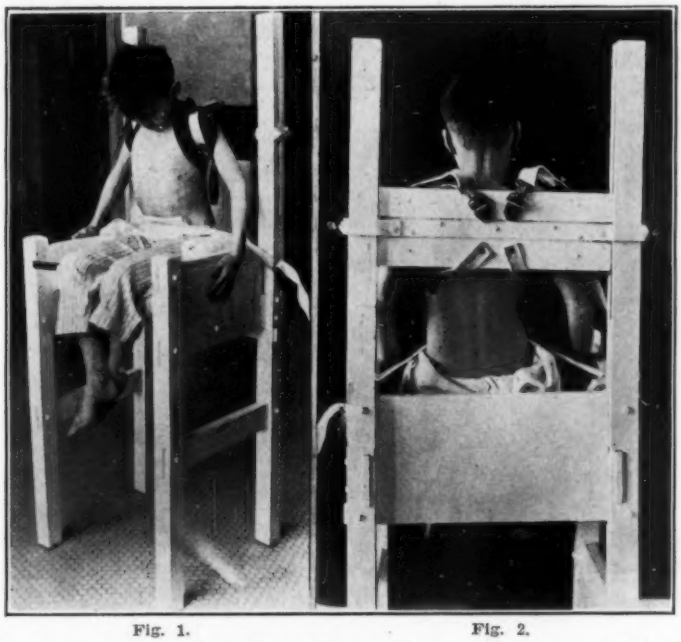

Fig. 1. Fig. 2.

Fig. 1.—Patient secured in chair. Note padded shoulder straps, padded strap stabilizing pelvis, and padding between hips and side rails. One section of seat has been removed to accommodate patient's short legs.

Fig. 2.—Posterior view of patient in chair. Note adjustable back support with shoulder straps attached. Pelvic strap is in position.

support. These then pass laterally and forward up under the patient's axillae and back over his shoulder to be secured by buckles on the back support (Figs. 1 and 2). Pieces of 0.5-inch felt are used to pad the points of pressure over the shoulders, and the back support is faced with sponge rubber covered with artificial leather to insure comfort and cleanliness (Fig. 3).

The back support consists of a piece of 1-inch stock about six inches in width. This slides vertically in grooves on the inner surfaces of two

lateral wooden uprights (20 inches apart and rising 36 inches above the back of the chair seat). The back support may be clamped at any desired height by a thumbscrew and collar arrangement encircling each upright (Fig. 2). Not only is this readily adjustable to any child's shoulder height, but it may also be removed entirely over the uprights, and always leaves the lower back fully exposed (Fig. 2).

The patient's pelvis is firmly stabilized in the chair by a combination of several devices. In the first place, the chair seat slopes downward posteriorly so the patient always tends to slide into, rather than out of, the chair. The back of the pelvis comes to rest against a back rail rising 3 inches above the seat. This does not obstruct the lumbar region of even a very small child (Figs. 2 and 3). The pelvis is further held down against this back rail by a strap passing from the base of each

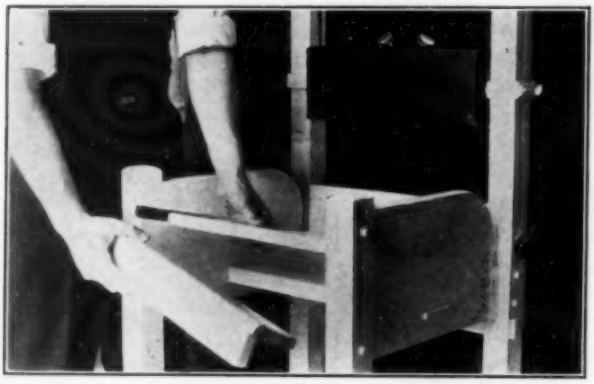

Fig. 2.—Detail of sloping seat with removable sections and rounded edge-piece. Note side and back rails of seat and collar and thumbscrew for clamping the back support.

back upright around the patient's waist in such a way as to engage the iliac crests anteriorly. This strap is secured at both ends by the same quick-release type of buckle used on the shoulder straps. Pressure of this strap over the abdomen is distributed by a pad of folded towel or similar material (Fig. 1). To prevent lateral motion of the pelvis, the seat is bounded by two low side rails, and the space not occupied by the patient's buttocks is filled in by folded blankets (Fig. 1). Finally, the seat of the chair is made in a number of removable, sliding sections (Fig. 3). Sufficient sections are left in place so that the patient's knees just flex over the edge (a specially rounded section always being used at this point, Figs. 1 and 3). In this way the chair seat is adjustable to the patient's thigh length, and further comfort and stability are provided.

ROENTGENOGRAM

At the present time at the Emma Pendleton Bradley Home roentgenograms are taken after air injection by pushing the entire apparatus up to a vertically suspended portable Potter-Bucky diaphragm, without removing the patient from the chair. Films are taken in the upright position, the head being held against the diaphragm by a cotton strip fixed with a ratchet, or a metal yoke with padded head clamps, depending on the projection desired. The further details of roentgenography are adequately described elsewhere.[2, 3, 4, 8, 9, 11, 12]

DISCUSSION

The major theoretical defect in the chair is that the position and elevation of the patient's body cannot be changed without removing him entirely from the apparatus. Practically this seems to make little difference, as others have shown that the entire procedure may be effectively carried out in the sitting position.[2, 4] As a matter of fact, the patient's subsequent unfavorable reactions seem to be eliminated in proportion to his freedom from manipulation. Furthermore, lifting a child in and out of the chair in case of emergency does not present the mechanical problems encountered in heavier adults.

In passing, it may be well to note that the features of adjustability, stability, and instant release incorporated in this chair might well be employed in any apparatus designed to hold an anesthetized child in the sitting position during other surgical procedures, such as may be desirable in nose and throat work.

SUMMARY

A chair is described in which anesthetized children of any size may be firmly and indefinitely held in the sitting position during encephalography.

NOTE.—The author is indebted to Mr. Joseph D. Toomey for many practical suggestions and the actual construction of the chair.

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INSTITUTIONAL MORTALITY OF THE NEWBORN: A REPORT OF 10,000 CONSECUTIVE BIRTHS

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IN 1915 Holt and Babbitt[1] published statistics on the institutional mortality for the newborn infant during the first fourteen days of life on ten thousand consecutive births. Our data for an equal number of consecutive births are shown in Table I. For the purpose of comparison we used the same classification for the causes of death.

An analysis of our study when compared with the findings of twenty years ago shows a marked fall in the total mortality. Of the 201 deaths, 127, or 63.2 per cent, were in infants born prematurely; 74, or 36.8 per cent, occurred in infants born at term. The changes to be noted under the various causes of death will be discussed separately.

Congenital weakness as a group accounted for 74 deaths, or 36.8 per cent of the total mortality. This group is made up entirely of premature infants, and as a cause of death this still remains the largest and most important factor in infant mortality.

TABLE I

CAUSES OF DEATH DURING FIRST FOURTEEN DAYS IN 10,000 CONSECUTIVE BIRTHS

AGE AT DEATH	UNDER 1 DAY		2-7 DAYS INCLUSIVE		8-14 DAYS INCLUSIVE		TOTAL		SWANSON ET AL.	HOLT AND BABBITT
	PREMATURE	FULL TERM	PREMATURE	FULL TERM	PREMATURE	FULL TERM	PREMATURE	FULL TERM	GRAND TOTAL	GRAND TOTAL
Congenital weakness	62	0	11	0	1	0	74	0	74	143
Accidents of labor	14	23	9	6	0	0	23	29	52	33
Pneumonia	0	0	0	1	2	1	2	2	4	28
Atelectasis	3	0	0	0	0	0	3	0	3	25
Congenital syphilis	0	0	1	0	0	0	1	0	1	13
Malformations	8	11	2	8	1	0	11	19	30	12
Hemorrhage	0	0	0	1	0	0	0	1	1	10
Sepsis	0	0	0	0	0	2	0	2	2	9
Asphyxia	13	13	0	0	0	0	13	13	26	8
Accidental	0	0	0	0	0	0	0	0	0	2
Undetermined	0	1	0	7	0	0	0	8	8	8
Total	100	48	23	24	4	3	127	74	201	291

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Accidents of labor are the next most important cause of death. In this group the full-term infants show a higher mortality than premature infants. Of the 52 cases tabulated, 40 cases had cerebral hemorrhage verified by postmortem examinations; in 9 cases cerebral injury was diagnosed clinically; in 2 cases there were ruptured hematomas of the liver; and in 1 case, a ruptured liver with hemorrhage. This group constitutes 25.4 per cent of the total mortality.

Pneumonia and upper respiratory infection played a small part in the total death rate. The four cases listed were diagnosed from postmortem findings.

Atelectasis as a cause of death is not a justifiable diagnosis in most instances. Only three cases, all in premature infants, appeared to belong in this group.

Congenital syphilis was the cause of death in only one instance, that of a premature infant.

Malformations were found to be the cause of death in 30 cases, or 14.9 per cent of the total mortality. An analysis of this group shows that death was attributable in 8 cases to cardiac anomalies, in 11 cases to monstrosities (6 hydrocephalus, and 5 anencephalus), in 4 cases to multiple congenital anomalies, in 2 cases to diaphragmatic hernias, and in 1 case each to abdominal hernia, esophageal atresia, polycystic kidneys, and imperforate anus.

Under hemorrhage is considered only the condition known as hemorrhagic disease of the newborn. This cause accounted for a single death.

Sepsis was the cause of death in two infants. One baby developed meningitis following laceration and fracture of the left parietal bone. The other died from an infected umbilical cord.

Asphyxia is given as the cause of death in 26 cases, 12.9 per cent of the total. This group includes both full-term and premature infants, many dying within a few hours after birth, all within the first twenty-four hours. The causes for the asphyxia were in most instances due to laryngeal or tracheal obstruction, abnormal position of the cord, placental separation, and prolonged difficult labor.

In the undetermined group there are eight cases listed since no cause for death could be fairly determined, even though a few had postmortem examination.

The differences that are apparent in the grand totals in the table from Holt and Babbitt[1] and the present study should be cautiously compared. The number and causes of death may in part be circumstantial since time and place are important factors. Our data would show a still lower total mortality if the eleven monsters had been included with the stillbirths as was done by Holt and Babbitt. How

much the decrease in the present total mortality may be attributed to progress in medicine cannot be readily determined.

In the ten thousand consecutive births there were 225 stillbirths and 9,775 live births. Our mortality rate based upon live births is 2.06 per cent. In 9,318 infants born alive, Holt and Babbitt[1] found that the mortality rate was 3.1 per cent. In an earlier contribution dealing with 9,610 living births, Kerness[2] found a mortality of 2.5 per cent. Our stillbirth mortality for the 10,000 consecutive births is 2.25 per cent, and that of Holt and Babbitt, 4.29 per cent.

TABLE II

DEATHS IN 664 PREMATURE INFANTS DURING THE FIRST FOURTEEN DAYS DISTRIBUTED ACCORDING TO WEIGHT, GESTATION, AND CROWN-HEEL LENGTH FROM 10,000 CONSECUTIVE BIRTHS

WEIGHT IN GM. AT BIRTH	UNDER 2,500		OVER 2,501		
Period of gestation	37 WEEKS OR UNDER	OVER 37 WEEKS (UNDER 47 CM.)	TOTAL	37 WEEKS OR LESS (UNDER 47 CM.)	TOTAL
Lived more than 14 days	282	172	454	83	537
Died during first 14 days	111	11	122	5	127
Total	393	183	576	88	664
Group mortality percentage	28.24	6.01	21.18	5.68	19.13

TABLE III

MORTALITY DURING THE FIRST FOURTEEN DAYS OF 664 PREMATURE INFANTS IN 9,775 CONSECUTIVE LIVE BIRTHS GROUPED ACCORDING TO WEIGHT

BIRTH WEIGHT IN GM.	NUMBER	NUMBER OF DEATHS				NUMBER ALIVE AFTER 14 DAYS	MORTALITY PER CENT
		WITHIN 24 HR.	2-7 DAYS, INCLUSIVE	8-14 DAYS, INCLUSIVE	TOTAL		
Under 800	15	15			15	0	100
800 to 1,000	16	14	2		16	0	100
1,001 to 1,500	48	27	7	1	35	13	72.9
1,501 to 2,000	153	25	7	2	34	119	22.2
2,001 to 2,500	344	14	7	1	22	322	6.39
Over 2,500	88	5			5	83	5.68
Total	664	100	23	4	127	537	19.13
Per cent of deaths		78.74	18.11	3.14			

A separate study of all the premature infants in the 9,975 living births is found in Tables II and III. Premature infants as determined by recognized measurements constituted 6.8 per cent of the total. In Table II the limits of the measurements used in determining whether or not an infant belongs to the premature group are briefly recorded. A newborn infant weighing less than 2,500 gm. and under 47 cm. crown-heel length, and of less than thirty-seven weeks intrauterine life, should be considered premature. Also the infant

under 2,500 gm., over thirty-seven weeks of intrauterine life, but under 47 cm. crown-heel length, should be considered premature. We have, in addition, included a group of newborn infants weighing more than 2,500 gm., but under 47 cm. crown-heel length, and of less than thirty-seven weeks intrauterine life.

In Table III the premature infants have been classified according to weight and the percentage mortality determined for each group. It is discouraging to note that almost 75 per cent of the total mortality occurs within the first twenty-four hours. However, the death rate for the entire group compares favorably with figures published by Blackfan and Yaglou[3] and later by Hess.[4] A more complete and critical review of the premature group covering their entire stay in the hospital will follow.

SUMMARY

In 10,000 consecutive births there were 225 stillbirths (2.25 per cent) and 9,775 infants born alive, of whom 201 infants (2.06 per cent) died in the hospital during the first fourteen days of life.

Congenital weakness, accidents of labor, malformation, and asphyxia accounted for 90.5 per cent of the total deaths.

In 9,775 consecutive live births there were 664 premature infants of whom 127 died (19.13 per cent). The total mortality for the premature infants accounted for 63.2 per cent of the 201 deaths.

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Pediatric Clinics

THE UNIVERSITY KINDERKLINIK IN VIENNA

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THE University Children's Clinic in Vienna was built according to the plans of Escherich and von Pirquet and later considerably altered and enlarged. It consists of a main building and two pavilions intended chiefly for cases of infectious disease. One pavilion now accommodates cases of infectious diseases (diphtheria and scarlet fever) in the Hochparterre, and internal medicine on the first floor. In the second pavilion is the school for the children of the open air ward and the mental hygiene station of the children's clinic, which was developed by Pirquet for Lazar. This serves as a diagnostic and therapeutic clinic for children with mental and behavior problems. Connected with it is a large out-patient service which is used by the schools, children's workers, and the juvenile court for consultation purposes.

Cases of infectious disease important for teaching purposes are cared for in the infectious division, built on the cubicle system, located in the main building, and having a separate entrance from the outside. While this ward is used also for the observation of patients in whom the diagnosis is uncertain on admission, it serves chiefly for the care of patients with infectious disease and of those in whom infectious disease is suspected. It consists of twelve separate rooms, separated by a "clean" middle passage; each unit accommodates two, or at the most three, children. With such an arrangement it is possible to take care of all cases of the infectious diseases, with the exception of measles and chickenpox, without the danger of cross-infection. The total capacity of the clinic is 230 children.

In the basement of the main building are the out-patient department, the office of the nurse in charge, an x-ray laboratory, clinical laboratory, and special scientific laboratories as well as two small lecture rooms. The first floor contains a ward for internal disease, a room for patients with severe tuberculosis for whom the open-air treatment is inadvisable, and three single rooms for special cases. On the same floor are some living quarters for assistants, the auditorium, and the offices of the chief of the clinic. The lecture hall holds 400 and is used for the lectures at the clinic and for meetings of the Pediatric Society, whose president is the chief of Clinic. In the rear of the lecture hall are a museum, a preparation room, and quarters for two assistants. The library is reached through the lecture hall. The second floor contains the infant wards. No room contains more than four beds. In one room of the infant division are the cubicles designed by von Pirquet, in which it is possible to isolate six infants with respiratory disease or tuberculosis without danger to the other children. For carrying out open-air treatment of certain diseases there are three window balconies in the infant ward (one a so-called "Fensterstübchen" designed by S. Weiss and modified by A. Bratusch-Marrain and two "Fensterinnenbalkons" designed by Hamburger). On the same floor is a second ward for twenty patients with internal diseases; this is divided into half cubicles by glass walls by means of which the danger of respiratory infection, especially to the younger patients, is minimized.

In 1918 an open-air pavilion was built on the roof by von Pirquet for children with tuberculosis. It is divided into two wards. Twenty beds are reserved for bed patients with severe, but prognostically good, tuberculosis, while 60 beds are utilized for patients with mild ambulatory cases who are able to attend school. This latter division is not a clinical ward but more of the nature of a tuberculosis sanatorium with homelike surroundings. Connected with it is a school with two teachers, so that the school work of the children in the open air wards is not interrupted. In the basement of the main buildings are, as mentioned above, the out-patient clinic for treatment of noninfectious and infectious conditions, and especially equipped rooms for dentistry, ophthalmology, and orthopedics. The attendance at the out-patient clinic averages 100 children a day. There is also an infant welfare center in the dispensary where twice a week normal infants from a definite district in Vienna are brought for examination and advice. In the basement is a central kitchen in which the cooking is done in a "caloric method" according to the work of von Pirquet, so that the exact food value of the prepared food is known. Since the food of the children is weighed before serving, it is possible to determine the exact intake of each meal for every child. There is also a milk laboratory in the basement. The main building is connected with the pavilion by underground passages.

Lectures on pediatrics for students, with demonstration of patients, are held by the chief of clinic (Prof. Dr. Hamburger) during the winter semester (October to Easter) three times a week for an hour and a half each. In the summer semester (Easter to the middle of July) lectures are given five times a week for an hour each. In the winter semester chiefly, the diseases of children and the infectious diseases are covered; in the summer semester, the diseases of the newborn and infancy.

The purpose of instruction is to make the student acquainted with the important fundamentals of the subject. It is in no way attempted to make him a specialist nor to burden his mind with theories which so often are not based on safe foundations. Moreover, a digression into the theoretical and less important fields of pediatrics in a course of lectures, which the student usually attends five hours a week for two semesters, would make it difficult for him to separate the important from the unimportant. Therefore, everything in question, everything simply theoretical, everything unimportant, everything which for the practitioner cannot be easily mastered is only briefly mentioned, so that the future practitioner, who in his practice works under difficult conditions and without special scientific or technical aids, is put in a position to recognize and treat the most important diseases and the ordinary clinical pictures they present. In keeping with this viewpoint especial attention is given to the recognition and treatment of the important diseases of childhood, that is, the most frequent, the dangerous, and the curable. Together with the technical knowledge, the student is instructed in the handling of the small patient. This aim of instruction is carried out through clinical lectures and practical exercises in groups. Suitable patients are sent to the lecture from the out-patient clinic by the assistants and are there examined and discussed by the chief of clinic without having been seen or examined by him previously. In this way the student has the opportunity to see the building up of a diagnosis and to witness the way in which the patient and family are approached. In addition to these ambulatory patients, in whom method of handling resembles that during the office hours of the physician, thoroughly studied hospital cases are demonstrated, and the clinical picture, diagnosis, and treatment are discussed. Through repeated demonstration of the same cases and a final summary it is attempted to depict and impress upon the mind of the student the course of a disease. By the repeated brief demonstration of typical disease pictures it is attempted to call back to mind the characteristic features and so sharpen the eyes and ears of the student.

In addition to this practical instruction there is a systematic consideration of the scientific knowledge of the infectious diseases, especially tuberculosis, and the important scientific background of the nutritional diseases of infancy. Because of its importance, considerable attention and time are given to the neuroses and the psychogenic diseases and to the influence of psychic factors on organic disorders. It has been shown lately that more than two-thirds of all chronic disorders of childhood are of a neurotic nature.

Supplementing the lectures are practical exercises, in which the student is offered the opportunity to obtain practice in the art of examining the child and to carry out minor procedures under direction. These practical exercises, which are not obligatory but have a good attendance, are conducted in groups by the assistants. Each lasts for a week for a group, the mornings being spent in the different wards of the hospital and the afternoons in the out-patient clinic. One morning is given over to practical work in the milk kitchen, where the preparation of simple milk formulas is shown and discussed. This is especially valuable to the future practitioner to whom the mother goes for help in questions of diet.

The graduate and postgraduate training of physicians further falls upon the chief of clinic and his assistants. For postgraduate work twelve Austrian physicians are assigned to the clinic for a year. During this time they serve in all departments of the hospital. Besides these, native and foreign physicians of different nationalities work in the clinic for training in pediatrics. These make a monthly payment to the Library and Laboratory Fund of the clinic. The minimum length of time which foreign physicians must stay in order to obtain a certificate of attendance at the clinic is three months. Physicians who cannot pledge themselves for this length of time can take short courses which are given by the assistants throughout the year in both German and English. There is a "Course Bureau" in Vienna for German-speaking physicians, which acts for all foreign nationalities with the exception of the English-speaking physicians, and the American Medical Association* which organizes courses for American physicians.

The postgraduate courses of the university department of pediatrics are given by the assistants of the clinic. They as a rule cover all special branches of pediatrics. These courses are given also in English. In addition so-called out-patient courses are given, i.e., practical courses on pediatrics using the unusually rich polyclinical material of the out-patient service. These courses are also given in English and French.

The courses are continuous and consist of from five to fifteen hours, according to the subject. Some of the assistants, the "Docents" of the clinic, are also engaged in student instruction and hold lectures on selected pediatric subjects. The first assistant is responsible for the obligatory one hour course on vaccination. In addition to the above described graduate instruction, the clinic takes part in the organized medical extension courses of the Vienna medical faculty.

Instruction is given to nurses in the diseases and care of children at the clinic. This includes instruction in pediatrics and child care to the students of the Municipal nurses' school of the "Allgemein Krankenhaus," to the school for nursemaids at the children's hospital at which a one year course is given, and to the students in the course for social science at the University who take a theoretical and practical course in infant and child care and in the diseases of childhood. The theoretical part of this teaching is given by the chief and his assistants, and the practical instruction by the teaching sister of the clinic.

*A local Vienna organization not connected with the American Medical Association in the United States. *Editor.*

The Austrian University clinics are not only hospitals, but, according to tradition, are institutes of investigation for the medical sciences. The research work extends into the entire field of pediatrics.

The assistants have certain administrative duties apart from their hospital work, teaching and investigation. The first assistant is the treasurer of the clinic funds and represents the chief at meetings or on committees when necessary. Another assistant is librarian, and so forth. For every physician a reference file card is made out on which are entered his personal data and the divisions of the clinic in which he has worked. In addition to the clinical assistants, there are ten paid and two unpaid "Hilfsärtze" who, like the assistants, must be citizens of Austria. They are appointed by the dean of the medical faculty upon nomination of the chief of clinic. As a rule, they are appointed for a period of one year and hence do not come in the same category as the assistants who remain for a longer period of time. Different specialists (orthopedists, dentists, and dermatologists) attached to the clinic hold consultations for ambulatory cases on definite days of the week.

The six assistants devote their entire time to their clinic duties and have no outside practice. The twelve "Hilfsärtze" are not allowed to practice outside.

It is not possible to give the exact budget for the clinic, since the university clinics are in part incorporated in the "Allgemein Krankenhaus" and in part are supported by the federal ministry for education. In its function as a hospital for the care of the sick, the clinic belongs to the "Allgemein Krankenhaus" and accordingly to the so-called "Krankenanstaltfonds-Spitälern." There is a central management for the hospitals belonging to this fund, and the individual chiefs have no exact knowledge. The stipend of the assistants is about 300 Sch. per month and that of the Hilfsärtze, 200. For research the university clinics receive funds from the Ministry of Education.

The clinic possesses a technical pediatric library which includes the more important journals and textbooks. A part of the cost of this is borne by the previously mentioned contributions of foreign students to the Library and Laboratory Fund. Since the clinic can use this fund as it wishes, it is possible to supply many needs in a rapid way instead of the slow way of requisitions.

The basic lines of the students' training at the bedside have been given above. The practical training of the student used to be done in the past chiefly in the so-called "Praktikum." In addition seminars in pediatrics are held for groups of students before their examination, which are not obligatory but are attended by most of the student body. There are likewise, as mentioned above, lectures in the special fields of pediatrics in addition to the main course of lectures. A cooperative function of the children's clinic with other university clinics may be mentioned at this point. This is the service in the newborn department of the obstetric clinic. Designated assistants of the children's clinic are appointed as consulting physicians. It is thus possible to make use of the large number of newborn infants of the obstetric service for student instruction and research at the children's clinic. Likewise the assistants have consulting duties in the children's wards of the remaining hospitals (ear, nose and throat, eye, skin, and surgical clinics).

In the relation of a personal union the clinic is connected with the Herzmansky Children's Home in Weidlingau which is not supported by the Hospital Fund nor the Ministry of Education. The chief of clinic is curator of the endowment, the first assistant, his treasurer. The Home lies in the "Wienerwald," twelve kilometers from the clinic. It has accommodations for 140 children and is conducted as a tuberculosis sanatarium and preventorium. It has a hospital school attached. The children sleep mostly in an open-air pavilion; they have playgrounds, woods and a swimming pool.

Critical Review

SURGICAL PEDIATRICS

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IN A survey of the current medical literature of the past year, it is difficult to distinguish a definite trend of medical opinion as regards the subject of this review. The fundamental facts that infants and children differ from adults in anatomy, physiology, psychology and their reactions to environmental influences, and that the necessary adjustments of surgical procedures are not merely matters of scale, have apparently become so well established that the necessity for stressing this concept is not as great as in the preceding few years.

One subject, featured rather extensively, has been called "the acute abdomen of childhood." The reviewer has consistently objected to this term as being loose, inaccurate, etymologically unsound, and typical of all that should be studiously avoided in scientific terminology. It is medical slang, but, as so often occurs with slang, it seems to be acquiring a definite place in our vocabulary. No doubt the reason for its persistence is that it is striking; it arrests the attention; it suggests an emergency and the necessity for accurate and immediate action; and since the slang of today often becomes the accepted usage of tomorrow, we may as well accept it and make the best of it.

Brennemann[1] in his delightful and inimitable style gives a picture of acute abdominal conditions in infancy and childhood which is difficult to condense into the limits of a review. Every sentence shows breadth of experience, keen observation, and clear, accurate deduction. He stresses particularly the importance of the pediatric approach. This term sums up the attitude of the examiner toward the parents, his evaluation of the appearance of the child, his method of eliciting symptoms or signs, his method of palpation, and in general the way in which he handles the patient.

There are three types of acute abdominal surgical conditions in infancy and childhod: obstructions, hemorrhages, and inflammatory conditions. Obstructions are always characterized by vomiting. The distinction between pylorospasm and pyloric stenosis is often difficult on account of similar symptomatology. Atropine may be depended upon to give relief in pylorospasm. When given in sufficient doses to relax the pylorus, it may cause fever as high as 109° F., but such a temperature from this cause does no harm. The operative results in pyloric stenosis are extremely satisfactory, and there should be no hesitation in recommending operation if medical treatment does not seem to be producing results. Duodenal obstruction may occur from bands, either congenital or adhesive, and gives many of the same symptoms as pyloric stenosis. The vomitus, however, in the majority of instances contains bile. The most

common type of intestinal obstruction is caused by intussusception, usually beginning at the ileocecal valve, except in older children when it may be due to a Meckel's diverticulum. The onset is sudden and striking, with acute abdominal pain and colic. During the first day there are intermissions and the child is comfortable between paroxysms. After the first day the expression is characteristic. The child never smiles. He looks apprehensive as if waiting for the next pain. In the diagnosis, barium should not be used. The treatment is surgical and recurrences are extremely rare, practically never occurring in the ileocecal type. A condition seen in young infants causing marked distention of the colon is anorectal stricture. In most instances this can be cured completely and satisfactorily by repeated dilation of the anus with the finger.

Hemorrhage of the newborn may be confined to the bowel or may be associated with hemorrhages elsewhere. In the former the patient recovers regardless of the type of treatment. In the second type, on the contrary, the patient should be given blood transfusions. Gastric and duodenal ulcers may cause hemorrhage, but they are extremely rare. In older children intestinal hemorrhage may come from purpura, from foreign bodies, or from an ulcer in a Meckel's diverticulum. The hemorrhage from an ulcer in a Meckel's diverticulum is dark at some times and bright at other times, is characterized by the presence of large clots, and is usually large in amount. Occasionally hemorrhage from the bowel may be due to a rectal polyp.

Appendicitis, which is still the cause of a voluminous literature, is the most common inflammatory abdominal condition. Important points of diagnosis are that the pain occurs first in the region of the navel, shifting later to the right side, and that the acute tenderness is sharply localized to a very small area. Tenderness is usually greater than pain. Abdominal pain may be coincident with a sore throat; but, since appendicitis is frequently associated with respiratory infections, one should not be blinded by the presence of a sore throat and neglect a careful abdominal examination. In cases of doubt it is best to operate. However, if symptoms are of three or four days' duration, if there is a mass in the abdomen, or if there is peritonitis, an operation should be performed only after careful study and on very definite indications. Rectal examination is not always necessary as it is usually possible to make the diagnosis without it. A condition which, although it is rare, may be confused with acute appendicitis, is a twisted pedicle of an ovarian cyst. Symptoms and physical findings may be the same as in acute appendicitis; however, a mass appears much earlier; the fever is high, and a leucocyte count of 60,000 to 80,000 may be present.

In the many articles referring to acute abdominal conditions in children, the point is frequently stressed that such conditions are not necessarily surgical, in fact the majority of conditions causing acute abdominal symptoms are definitely nonsurgical and in many instances are not even abdominal.[2, 3] Pain itself is frequently of little significance and must be taken in conjunction with other symptoms and findings. It may be due to scoliosis or a strain of the lumbar muscles[4] or to conditions in the wall of the abdomen.[5] If the cause of pain is parietal, voluntary rigidity will not alter the tenderness; whereas, if it is visceral, such temporary rigidity will often protect the tender point. The onset of

poliomyelitis may be characterized by abdominal pain and vomiting. Symptoms in the front of the abdomen of a child always indicate listening to the back of the chest[6] and call for a careful investigation as to history of injury, previous illness, or other symptoms. Abdominal trauma from automobile injuries requires careful study and treatment. Shock may mask serious symptoms so that hemorrhage may give no symptoms whatever until it has reached serious proportions. A urinalysis for blood is particularly essential in the differential diagnosis of ruptured kidney[7] which may be characterized by the presence of marked rigidity, tenderness, and moderate leucocyte count. Surgical intervention is often necessary upon short notice, and medical and surgical cooperation should be close and harmonious if the best interests of the child are to be served and unnecessary mortality and morbidity avoided.[8] Pathologic processes progress very rapidly in early life, and incorrect or delayed diagnosis is a factor in high mortality.[9] It is to be borne in mind, however, that the child's abdomen is no place for heroic surgery.[10]

ANESTHESIA

It is gratifying to note the steadily increasing use of basal anesthesia, and it is devoutly to be hoped that the induction of smooth, quiet, peaceful sleep will continue to supplant the still too frequently seen medieval spectacle of superior brute force restraining a child on a table while he passes screaming into a suffocating unconsciousness, with the inevitable bi-product of hatred of the medical profession and incalculable psychic shock. The rectal anesthetic, avertin,[11] and the intravenous anesthetic, evipal,[12, 13] have been used in so many thousand cases that the indications and contraindications are well established. Evipal will produce total anesthesia of short duration and by giving repeated injections has been effective up to two and one-half hours. The term evipal and evipan are synonymous, the former being used more in the United States and the latter, in Europe. Postoperative recovery is smooth and usually without nausea, vomiting, or excitement. The same precautions are necessary as with other barbiturates, particularly to avoid blocking the air passages by the tongue's falling backward. The pupillary reactions are variable and unreliable, the respirations being an index of the depth of anesthesia.[14] It is contraindicated in toxemia or severe infections of the upper respiratory tract. Preoperative medication with morphine is unnecessary except when prolonged anesthesia is desired. No bad effects have been observed following slight leakage around the vein during administration. Among the contraindications to the use of avertin should be mentioned the sequelae of poliomyelitis in which there may have been an early involvement of the respiratory center, a death in such a case having been reported as possibly due to this anesthetic.[15] Coramin is an excellent, quickly acting antidote. It is usually given intravenously in doses of 5 c.c. to 10 c.c., but as it is apparently nontoxic and the effects are not cumulative, it may be given in larger doses or the injections repeated if necessary to produce the desired effect.[16] It is effective also in the collapse or depression incident to any hypnotic or narcotic and has been used effectively in cocaine poisoning during spinal or local anesthesia, in morphine and luminal poisoning, and for collapse under ether anesthesia. It is slightly less

effective in depression due to amytal than in that due to other barbiturates. The action is to stimulate circulation and depth of respiration without varying the respiratory rate.

Cyclopropane, an anesthetic agent for use in a closed system with the carbon-dioxide absorption technic, has found favor in certain cases,[17, 18] but it requires the services of a skilled anesthetist and the closest of observation during the period of anesthesia. It appears to have no particular advantage over other anesthetic agents except in cases of pulmonary disease,[19] in which it is ideal as it does not increase bronchial secretions and apparently causes no irritation of the upper respiratory tract or lungs.

The most recent addition to the anesthetist's repertoire, and one which bids fair to become an important part of it, is vinethene, or vinyl ether. This substance is an inhalation anesthetic producing rapid surgical anesthesia, full anesthesia being obtained in some instances within two minutes. There is no sensation of suffocation although the odor is slightly disagreeable, by some being said to resemble garlic and by others considered slightly suggestive of gasoline. The odor, however, may be disguised by any of the usual aromatic substances used with ether. The return to consciousness is rapid and complete without nausea, vomiting, delirium or other untoward symptoms. It may be administered by the drop method in the same manner as ether. On account of its high volatility it must be watched carefully during administration, as the patient passes into and beyond the zone of safe anesthesia rapidly. In overdosage, respiratory failure occurs before cardiac failure as with ether. It is the ideal inhalation anesthetic for infants and children on account of its short, pleasant induction and absence of after-effects. It has been used in all types of surgical procedures. While it seems to be best in operations of relatively short duration,[20] its use in longer ones is possible, anesthesia having been maintained for two hours and forty minutes. Preoperative medication with atropine is advisable on account of the increase in mouth secretions. This increase in secretions, however, apparently does not extend to the respiratory tract as it has been used with excellent effect in pneumonia and in patients with other pulmonary complications. It possesses the best characteristics of ethylene and ether without their disadvantages. Its advantages are so definite and so numerous[21] that it has been acclaimed the answer to the anesthetist's prayer. The only disadvantages are that it is still rather expensive, that it is highly volatile, and that it is somewhat unstable, undergoing decomposition with the appearance of irritating end-products after rather limited exposure to light and air. It will not be well received by those anesthetists who desire to pay closer attention to the activities of the surgeon than to the administration of the anesthetic.

THE INTESTINAL TRACT

In spite of careful study and keen analysis by many of the best surgical minds in this country, the mortality from *appendicitis* in the United States still remains at an unenviably high point. These studies uniformly stress the necessity for early diagnosis and operation, the avoidance of cathartics, and the danger of peritonitis. The problem, however, seems to be the wider dissemination of this knowledge, a pertinent suggestion being that information should be given to high school stu-

dents,[22] thus reaching the incoming generation. An interesting and somewhat disconcerting comparison shows that the mortality in Great Britain has been steadily declining, a review of over 8,000 cases[23] showing a consistent decline during the past fourteen years. The main factor in this improvement is epigrammatically stated by the author as due to the fact that "we no longer greet the patient with one hand and thrust a knife into his abdomen with the other." This remark is amplified by the significant statement that, while the duration of the attack is an important factor, the pathologic condition of the appendix is more important. There is much food for thought in this observation in view of the fact that the mortality in this country is now nearly double that of England.[24]

As an aid in determining the stage of the pathologic process, particularly in children, the Schilling leucocyte count and the sedimentation test are of distinct value.[25, 26] The normal percentage of immature white cells in children is 10 per cent or less and with such a count appendicitis is hardly possible. The usual differential count is at times unreliable, but the presence of 10 to 15 per cent of immature forms is suggestive of an inflammatory process, and a count of over 15 per cent is a fairly definite indication that the process is progressing. The location of this process must be made by the usual methods of physical examination. During the conservative treatment of appendicial abscess or of subsiding peritonitis the Schilling count is of distinct value, an increasing shift to the left indicating a bad prognosis although not necessarily a fatal one. The count is of particular value in those occasional cases in which there is no elevation of temperature and a fairly normal pulse rate. The blood sedimentation test[27] is of value in differential diagnosis. Observations based on 2,000 cases over a period of two and one-half years indicate that in the presence of acute catarrhal, suppurative, or gangrenous appendicitis, the sedimentation rate is normal, but that it is abnormal in appendicitis with definite abscess formation or general peritonitis, and in acute pulmonary conditions, mesenteric adenitis, and the extraabdominal conditions which so often simulate the acute abdomen. An analysis of the many articles upon appendicitis in infancy and childhood shows a distinct uniformity of opinion regarding the symptomatology. With minor variations it consists of generalized abdominal pain, nausea, vomiting, and finally, localization in the right lower quadrant, the inability of the child to localize the pain definitely during the earlier stages being especially noted. At this point, however, the uniformity stops, some writers advocating immediate operation apparently regardless of the stage of the pathologic progress. An increasingly large number, however, are noting the sharp rise of operative mortality when operation is performed between the second and seventh days and are advocating conservatism and careful study during that period. Education of the profession is apparently equally important with education of the laity regarding the diagnosis of appendicitis and the danger of catharsis early in an attack of abdominal pain. The high and increasing mortality in the United States is variously attributed to the type and location of the operative incision, to the poor resistance of the child, to peritonitis, to a short, delicate omentum, to cathartics, to delay in diagnosis, and to the difficulty of diagnosis in infancy. In the British studies there is a tendency to stress the importance of

determining the time for operation by a careful evaluation of the pathologic process and a tendency to delay operation during the period of high operative mortality after the second day. One observer remarks significantly that in referred cases it is often morally difficult for the surgeon to delay operation when he should. This observation may well be heeded by the profession at large and careful analysis of it should result in closer cooperation between the general practitioner or the pediatrician and the surgeon. It should hardly be necessary to call attention to the fact that the welfare of the little patient is of first importance and that a change in a previously suggested plan of procedure is by no means a confession of incompetence, or a reflection upon the ability of the attending physician. The fact that figures may lie is proverbial, and the multiplicity of factors involved renders any comparison of statistical summaries open to question; but even after due allowance is made for this, the mortality statistics of Great Britain are definitely better than those of the United States, and a more careful evaluation of the stage of the pathologic process in determining the time for operation may well bear thoughtful study.

In young children the diagnosis is difficult, particularly in infants under the age of two years. The frequent occurrence of digestive upsets with abdominal pain and colicky cramps should not blind one to the fact that appendicitis can exist. In such infants it is often of value to make the examination during sleep, inducing sleep if necessary, by one of the barbiturates before making the examination. Pressure on the left side of the abdomen can often be made without arousing the child, whereas when the pressure is shifted to the right lower quadrant there is a definite reaction. Delay in calling a physician, which is all too natural in these early cases in infants, usually results in a perforation and the presence of peritonitis when the child is first seen. In a series of seventeen cases[28] before the age of five years, there were seven deaths, all of which occurred in children operated on between the second and the sixth day, the usual period of high operative mortality. To refrain from operating on an infant or young child during this stage requires a clearer knowledge of the pathologic process, a more sound surgical judgment, and a more secure professional standing in the community than is possessed by the average surgeon. Postoperative complications usually seen in adults, such as pulmonary embolism, pneumonia, or retention of urine are rarely seen in children. The complication most to be guarded against is postoperative rupture of the incision due to poor nutrition combined with crying and straining. Special care is necessary to avoid dehydration and acidosis. It is to be remembered that the younger the child, the greater the need of fluid in body metabolism and that, in addition to healing requirements, there are growth requirements. Fluid, salts, and food must be supplied or the child will begin to deplete his storehouses of reserve with a consequent slowing of metabolic processes and the development of acidosis. The most effective method of supplying fluid and salts is by intravenous administration, and the fact that the child has small veins should not be considered a reason for failing to use this method. Secondary abscesses should not be operated upon unless there is a very definite local indication, as the mortality following such operations is high.[29]

If the appendix has perforated and there is a spreading peritonitis, operation is contraindicated, as it is followed by an extremely high mortality[30] and the appendix may be removed secondarily eight to twelve weeks later with comparative safety. Appendicitis may occur during the course of any of the acute infectious diseases of childhood, the occurrence probably being coincidental rather than having the relation of cause and effect.[31] It has also occurred as the result of penetration of the appendix by intestinal parasites.[32]

An association between appendicitis and mumps, comparable to the complication of orchitis or ovaritis occurring during mumps, has been suggested, but again the occurrence would seem to be coincidental rather than a complication. The possibility, however, exists that the infection may have traveled from the mouth through the intestinal tract.[33] Abdominal pain during mumps should bring the possibility of appendicitis to mind. The leucocyte count in this connection is of value since during mumps there is usually an absolute and relative lymphocytosis. The presence of ovaritis does not change this ratio, but appendicitis and orchitis cause a rise in the percentage of neutrophiles.

The diagnosis of chronic appendicitis has been subjected to much criticism, but the fact that such a condition can exist is becoming more widely recognized.[34] The disfavor with which this term has been regarded has been due to the fact that it has been used as a diagnostic wastebasket, and that, on account of failure to eliminate all other possible causes of symptoms, the removal of the appendix has not been followed by relief. It is unquestionably true that a low-grade, chronic infection may exist in the appendix giving general vague symptoms of the condition. The symptoms are often referred to other parts of the abdomen, particularly the gastrointestinal tract, and may include disturbances of gastric digestion and of motility of the intestines. Differential diagnosis is extremely difficult, but the removal of the appendix, after a thorough and careful study has indicated such a course, is often followed by a distinct and striking improvement. A careful history will usually bring out symptoms suggestive of mild acute attacks, and there is often a slight but unmistakable residual tenderness in the right lower quadrant.

In cases of diffuse spreading peritonitis, attempts to drain the peritoneal cavity are doomed to failure, and it is to be hoped that the practice of inserting drains in many different directions among the coils of the intestines will soon pass into the discard. Drains, so placed, cause intestinal obstruction from adhesions and in the pelvis predispose to postoperative retention of urine.[35] The peritoneum isolates drains even more quickly than it does an inflammatory process,[36] and they often become encapsulated and plugged within a few hours. The removal of heavily infected peritoneal fluid is of course advisable, but a thin, cloudy fluid containing a large number of leucocytes is a peritoneal reaction to infection. Such a fluid often shows bacteria on direct smear but gives no growth upon culture. Extensive attempts to remove such fluid by mopping and disturbing the intestines mechanically are inadvisable, not only producing unnecessary trauma but actually depriving the peritoneum of protective substances. The treatment of peritonitis by drainage results in a higher mortality than that following conservative treatment. Therefore, when a perforated appendix has been removed in the presence of a general spreading peritonitis, it is good

surgery to close the abdomen without drainage, there being no logical reason for reversing or altering the treatment of choice for general peritonitis; and the more general the peritonitis without adhesions the less the reason for drainage.[37] This, however, does not apply to the abdominal wall and it is wise to leave the skin incision partly open, or to drain the interstitial spaces. There are, however, definite indications for abdominal drainage: first, when there is a retroperitoneal infection; second, when there is a localized abscess with necrotic tissue; and third, when there is uncontrollable oozing of blood. The best type of drain under ordinary circumstances is smooth rubber tissue,[38] but for the control of bleeding the hemostatic effect of a foreign body is better obtained by the use of gauze. In instances of a deep abscess which cannot be reached without passing through the clean peritoneal cavity a sinus tract may be formed by the insertion of rubber tissue or tubing down to the abscess. Experimental study has shown that such a tract becomes impervious to bacteria in about four or five days, after which time the drains may be removed and the abscess opened safely through this tract, thus avoiding the danger of contaminating the general peritoneal cavity. It is particularly important not to use gauze in the formation of such a tract as its removal will damage the tract wall.

The use of polyvalent serum in a series of 240 cases of general peritonitis is reported[39] with a mortality of 11 per cent. The method of administration was either intravenously in a 5 per cent glucose solution or intraperitoneally at the time of operation. This mortality is not greatly different from that following the conservative treatment of general peritonitis, and, since the measures used in conjunction with it are not stated, the report does not carry the weight which it otherwise might. The development of specific antibodies in general peritonitis has been stimulated by milk vaccine therapy.[40] Milk inoculated with peritoneal pus is incubated, sterilized and injected intramuscularly in the gluteal region, from 10 c.c. to 25 c.c. being used. Two doses are given at an interval of three hours, or several doses may be given at twelve- to sixteen-hour intervals. In cases showing a persistent high temperature, the dosage may be repeated in about two weeks. A series of control cases were treated with sterile milk on the theory that the improvement might be due to nonspecific protein shock but the results were unsatisfactory. The accompanying treatment consisted of morphine, intravenous fluid, and the application of heat to the abdomen. Eighteen cases were treated by this method with but one death, and, while the series is too small to draw definite conclusions, the reduction in mortality is so striking that further study would seem warranted. While upon the subject of mortality in general peritonitis, we cannot refrain from mentioning a report from Europe upon the treatment of general peritonitis by exposure of a loop of small intestine together with its mesentery to ultraviolet light.[41] After the exposure the intestine was returned to the abdomen, which was closed. Reference was made in the report to 108 cases of general peritonitis treated without a single death. In the absence of details of diagnosis and of associated treatment, proper evaluation is difficult and the report is perhaps more remarkable for its enthusiasm than for its statistical value.

Intestinal obstruction has lost some of its terrors, and the treatment has become more rationalized with the introduction of continuous duodenal suction siphon drainage. It is now well recognized that there

is a surgical and nonsurgical treatment, each with its appropriate indications.[42] The main features of the nonsurgical treatment are duodenal and colonic suction drainage, liberal use of morphine or other sedatives, adequate supply of fluids and salts by intravenous injection, the application of heat to the abdomen, and Fowler position; this treatment is indicated in general peritonitis, in postoperative ileus of the paralytic type, in partial mechanical obstruction, and obstructions due to adhesions. Paralytic ileus from operative trauma occurs soon after the operation; the paralytic ileus of postoperative peritonitis occurs from the third to the fifth day; and obstruction due to postoperative adhesions occurs after the fifth day. Under operative treatment is included ileostomy, removal of obstructions, exteriorization of the bowel, and anastomosis. The indications are: complete mechanical obstruction other than that due to adhesions, partial mechanical obstruction which does not respond to the nonsurgical treatment, strangulation obstruction, and obstruction of the large bowel. It may be difficult to differentiate between strangulation obstruction and the obstruction due to inflammatory adhesions,[43] the presence of rebound tenderness being an indication of the strangulation type. Great care is necessary in handling the distended bowel because it does not tolerate manipulation well. In older children nonviable bowel may be exteriorized, but in younger children and infants the mortality following exteriorization and intestinal fistula is high. Roentgenography is of value in diagnosis by showing gas and liquid levels and in checking the progress and effectiveness of continuous suction drainage. During the use of continuous suction drainage, it is particularly necessary to guard against dehydration, the signs indicating this condition being a rise in the red count and hemoglobin, a drop in the blood chlorides, a tendency toward alkalosis,[44] and a diminishing urinary output. There are at first few, if any, untoward symptoms, and a suggestion has been made that impending alkalosis be treated by collection of the duodenal contents, which are then strained, warmed and administered as a retention enema. It is advisable to use only a new, stiff, duodenal tube and in making several holes near the end, care should be taken not to weaken it. A case has been reported in which an old weakened tube failed to enter the duodenum and became tied in a knot in the stomach rendering withdrawal difficult.[45]

In the diagnosis and treatment of pyloric stenosis the former conflict between medical and surgical opinion has practically disappeared. There is some slight disagreement among various observers as to the necessity or importance of palpating the tumor and also as to the diagnostic value of roentgenography. In general, however, the symptoms are fairly definite and the operative indications, clear. Rammstedt, in a careful statistical survey of many hundreds of cases, concludes that the marked improvement in mortality is due to better diagnosis and adequate therapy. Operation is contraindicated if there is severe infection, if the child is moribund, and if symptoms have first appeared in the third month, this late appearance of symptoms generally indicating that the condition is functional and will disappear without operation.[46] A report of medical and surgical results in a large, well-controlled series of cases shows an 18 per cent mortality under medical treatment as contrasted with a 3.02 per cent mortality

under surgical treatment with the added advantage of a much shorter period of hospitalization. The excellence of surgical results may even tempt the internist to follow the line of least resistance and refer to the surgeon cases which might do well medically.[47]

A mass which protrudes from the anus of a small child or infant is usually a prolapse or an intussusception. It may, however, be a polyp or an enterogenous cyst.[48, 49, 50] A polyp usually has a long pedicle which may be easily transfixed and ligated. Amputation should be performed close to the polyp allowing the pedicle to retract and the rectal lining to become normal. An enterogenous cyst associated with the rectum causes symptoms of obstruction with loss of weight and anemia. Excision results in rapid recovery. It would seem possible perhaps that the incorrect diagnosis of intussusception and its succeeding laparotomy might have been avoided by a more careful abdominal examination and inspection of the mass presenting through the anus.

Malignant disease of the intestinal tract, although rare in children, is to be considered. A fibroid of the transverse colon with carcinomatous degeneration has been reported in a seven-year-old child, giving symptoms of intermittent obstruction and recurring abdominal pain without fever.[51] There was a palpable mass and a barium enema demonstrated the position of the obstruction. Death followed operative removal within twenty-four hours. The colon does not tolerate distention as well as the small bowel, and surgical procedures on it are attended by a high mortality, particularly in children. A high degree of surgical skill and careful attention to preoperative preparation and postoperative care are essential if good results are to be obtained.

Peptic ulcer occurs in children[52] and even in the newborn.[53] The diagnosis seems to be particularly difficult although in older children the symptoms are practically the same as those in adults. In the newborn, the adjustment of the gastrointestinal tract to the presence of food is attended by so many symptoms which disappear spontaneously that we are prone to assume that all symptoms will follow the same course. However, when there is persistent pain, vomiting, diarrhea, or blood in the stool, and failure to thrive, the possibility of peptic ulcer is to be considered. During early childhood there is usually recurring gastric discomfort with pain in the epigastric region particularly at night, often relieved by vomiting or the ingestion of soda or milk. A slender, undernourished child with these symptoms should be subjected to a careful gastrointestinal study and occasionally the reward will be the discovery of a peptic ulcer which may respond readily to medical treatment.

Meckel's diverticulum is said to be the most frequent congenital anomaly of the gastrointestinal tract, occurring in approximately 2 per cent of all individuals as shown by autopsy.[54] A large proportion of these, however, are silent and cause no trouble. The most suggestive symptom is recurrent intestinal hemorrhage. This indicates the presence of an ulcer and is a definite indication for surgical intervention. The presence of aberrant gastric or pancreatic tissue in such a diverticulum is the cause of ulceration which may go on to perforation. The mortality of perforation under medical treatment is practically 100 per cent since adhesions form in this location very poorly and fatal general peritonitis ensues. Surgical treatment following perforation is also attended by a rather high mortality, whereas surgical removal before

perforation is highly successful.[55] The roentgenologic diagnosis requires careful, persistent study, occasionally necessitating several examinations. After the barium meal has had time to reach the diverticulum, roentgenograms should be taken in the greatest possible variety of positions, because the diverticulum may open in any direction and the entrance of the barium suspension may be prevented by the presence of nonopaque secretions. Before hemorrhage has occurred, suggestive symptoms are: recurring abdominal pain with slight fever, slight rigidity or tenderness at or above the umbilicus, and diminished peristalsis. The advisability of the removal of the diverticulum before perforation has occurred is too evident to require further comment.

Intussusception.—A careful analysis of 372 cases[56] shows a marked and satisfactory reduction in the mortality although the results are still far inferior to those obtained in Australia. The improvement is ascribed to fewer resections on account of earlier operation, to increasing boldness in reduction, and to a better ability to estimate the viability of the bowel. While a Meckel's diverticulum or a polyp is a distinct factor in the etiology, such conditions occurred in only 5 per cent of the cases. A Meckel's diverticulum or appendix should not be removed at the time of operation. Neither should time be wasted in procedures designed to prevent recurrences, as any abnormal mobility of the cecum or ileum may be corrected at a later operation if necessary. Recurrences in this series occurred in less than 2 per cent of the cases and might occur in a different location from the original intussusception. Resection was attended by the usual high mortality, only two patients recovering in thirty resections. If resection is necessary, double enterostomy is preferred to anastomosis. A variation of the usual type of intussusception[57] occurred in a child of six months. The condition had existed over a period of five weeks, and the bowel protruded five inches beyond the anus without producing symptoms of obstruction. Reduction accomplished by barium enema on several occasions was unsatisfactory in that the terminal portion in the right lower quadrant did not seem to respond completely. At operation, exteriorization and later an anastomosis was done, followed however by death in forty-eight hours, emphasizing again the oft repeated fact that infants do not tolerate exteriorization or anastomosis well. Reduction by barium enema[58] will often give excellent results in early cases. The closest of supervision is necessary, and one should be prepared to operate immediately if the results are not thoroughly satisfactory. This type of reduction is not effective when the ileum has prolapsed through the ileocecal valve. That the danger from resection and anastomosis in older children is not so grave is shown by a patient, aged five years, in whom recurrent intussusceptions over a period of three or four years had been due to a polyp of the cecum.[59] Recovery followed resection and lateral anastomosis. A marked and steady improvement in the mortality of intussusception is possible and would seem to depend on constant reiterration before medical groups and in medical literature of the necessity of early diagnosis and early operation.

Intestinal obstruction may be due to congenital anomalies, such as: failure of normal rotation,[60] atresia, either single or multiple, peritoneal bands, and diaphragms which may be either perforate or imperforate.[61] Failure of normal rotation causes symptoms of acute or chronic obstruction, such as persistent or intermittent pain, colic, and vomiting; there

may be adhesions between loops of bowel or the leaves of the mesentery which render derotation particularly difficult. In complete obstruction the symptoms depend on the location. The vomitus may show bile or amniotic fluid and normal meconium stools may be passed for two to three days. Distention, however, gradually develops with unmistakable signs of obstruction. The roentgenogram is of value in showing the location of distended loops of bowel, and in cases of atresia of the sigmoid or rectum the child should be inverted allowing air to distend the terminal portion of the bowel before roentgenograms are taken. Careful preoperative preparation is essential, and the operation should be performed with the greatest delicacy, surgical skill, and avoidance of unnecessary manipulation. Again it is to be noted that anastomosis following resection gives a high mortality, and the preferable procedure is enterostomy or colostomy.

Tumor or cyst of the liver is to be considered in infants when there is a progressive enlargement in the upper right quadrant. Tumors may be malignant or benign. A case of a malignant adenoma in an infant six months of age is reported.[62] Such conditions cause few symptoms but are usually fatal, the only hope being in early surgical removal. With infiltrating lesions excision is usually impossible, but there may be a fairly well-defined capsule, and an instance is reported of successful removal at the age of seventeen days, the child being in good health three years later.

Acute signs and symptoms in the upper right quadrant should not always be considered as due to inflammation of a high appendix. Gallstones have been reported in early childhood, and cholecystitis occasionally occurs. Subdiaphragmatic abscess may follow pneumonia, or the burrowing upward of an appendicial abscess. The physical signs are difficult of interpretation. The diaphragm is not always elevated nor always immobile. If gas-forming organisms are present, the roentgenogram may show a crescent of gas below the diaphragm above the liver. A two-stage operation is usually necessary with prolonged drainage, and there is a tendency to recurrence. The mortality is rather high.

Sharp pain in the upper right quadrant and in the right axilla, accompanied by vomiting, was due in one case to a fistulous opening between the gallbladder and duodenum.[63] Appendicitis was suspected, but at operation bile-stained fluid found in the abdominal cavity led to the correct diagnosis. Recovery followed the restoration of normal conditions.

Embryonal carcinoma of the ovaries is reported in a child of two years.[64] There was enlargement of the abdomen with listlessness, pallor, loss of weight, and at times nausea and vomiting with abdominal pain. A history of abdominal trauma was thought to be significant, but the occurrence of the condition in both ovaries would make this cause seem less probable than a congenital cellular abnormality.

Abdominal trauma of slight degree may cause a ruptured spleen,[65] and symptoms in the upper left quadrant are particularly suggestive. The injury may be so trifling as to be easily forgotten. After a two- to four-day latent period a slight elevation of temperature may develop with pain in the upper and lower left quadrants or in the flank. Close observation is necessary because the hemorrhage may continue and

splenectomy may be required. Splenectomy has a definite place in the treatment of diseases of the blood in childhood; in general there are four indications: first, to stop a perverted or destructive activity of the spleen; second, to rid the body of the burden of an organ grossly enlarged and useless on account of disease; third, to check the progress of some poorly understood pathologic condition of the spleen; and fourth, to remove a lurking place for certain types of infection. The differential diagnosis of these conditions is often difficult but must be made with exactness if the results are to be satisfactory. Conditions favorable for splenectomy are: hemolytic icterus, purpura hemorrhagica, occasionally splenic anemia and splenomegaly with gastric hemorrhages. In erythroblastosis of the newborn, splenectomy may be of value when no real progress is made by repeated transfusions. Temporary physical relief may be obtained in erythroblastic anemia, in chronic leucemia, and Gaucher's disease, but there is no hope of real cure. In sickle-cell anemia and in chronic infections, where the spleen may be a possible focus, results are questionable, and the operation difficult on account of perisplenic adhesions. In such instances ligation of the splenic artery may be of benefit. It is to be considered as a substitute for splenectomy when removal is dangerous on account of adhesions.

Hernia.—In the ordinary hernias of infancy it is only fair to the child to give the truss treatment a trial,[66] a period of three to five months being suggested for an inguinal hernia and twelve to fourteen months for an umbilical hernia, any device which will restrain the viscera in the abdomen being considered adequate. With such an opinion we find it difficult to agree, as it does not seem reasonable to believe that the sides of a tube of peritoneum, in which at best there is the occasional presence of peritoneal fluid, will fuse together so solidly during a period of from three to five months, that it can successfully resist the hydrostatic pressure placed upon it by straining and crying. It seems more reasonable to require a period of at least twelve months under the ordinary conditions of home treatment for satisfactory fusion to take place. Also, the method of trussing an umbilical hernia by turning the skin inward and holding it with adhesive plaster is open to distinct criticism. It does not seem rational to expect a ring to close, when the method of treatment constantly forces tissues into it. The cure of umbilical hernia by this treatment has no doubt occurred in spite of it rather than because of it. True umbilical hernia occurs through a slightly oblique opening and flat pressure which holds the sides together and at the same time prevents the entrance of intraabdominal structures, would seem the more rational method of treatment. If trussing proves ineffective, of course, surgery is indicated, the results of operative treatment being almost uniformly excellent. Diaphragmatic hernia[67] is to be distinguished from congenitally high diaphragm and incomplete descent of the stomach. In incomplete descent the esophagus is short and part of the stomach is above the level of the diaphragm. Surgery is contraindicated. When hernia occurs through a congenitally weak place in the diaphragm, or an open hiatus, it is frequently due to trauma, the automobile being responsible for many of these cases. Such openings never heal spontaneously although the congenital type may cause no symptoms and be discovered accidentally later in life. In the traumatic type there are frequent gastrointestinal disturbances and strangulation is a danger.

This condition should be borne in mind whenever a child suffers abdominal injury. Except in an emergency, surgery should be advised only after a most careful study of the history and physical findings. The anatomy of the parts concerned renders the operative procedure somewhat difficult, but good results have been reported even in small infants.

CHEST AND RESPIRATORY TRACT

Any form of treatment of esophageal atresia is unsatisfactory on account of the almost invariable communication between one of the parts of the esophagus with either the trachea or a bronchus. In older children, however, complete esophageal obstruction due to stricture is amenable to surgery. A functioning esophagus has been obtained in a child of four years by a cleverly planned and skillfully executed series of operations using the jejunum, a skin lined tube and the upper end of the esophagus.[68] The report was made only a short time after the completion of the last stage of the operation, and it will be interesting to note the future functioning of this tube.

Cystic disease of the lungs may cause dyspnea in an infant without inflammatory signs.[69] The cysts may be single or multiple, large or small, and are thought to be due to congenital developmental defects. When a valvelike opening exists into a bronchus, there may be a marked increase in pressure within the cyst. Where the communication with a bronchus is free, or where there is no communication with a bronchus, the condition may be symptomless and be discovered accidentally later in life. Surgical excision of small cysts, the closure of bronchial communications by cautery, and the treatment of infected cysts by iodized oil are the measures recommended. This condition differs from the so-called congenital air cysts of the lung,[70] in which the roentgenogram shows no hilus stump and the entire side of the chest is filled with air. The symptoms in the case reported consisted of a harsh, dry cough, becoming progressively worse, vomiting, prostration, dyspnea, and cyanosis. The respiratory distress was evidently caused by the fact that the air was under greatly increased pressure, due no doubt to the presence of a one-way valve communicating with a bronchus. Under such circumstances the relief of pressure by needle puncture may be followed by collapse and death. Other similar cases have been reported in the literature. A possible explanation of this result is that there has been no opportunity for the mediastinum to have become stabilized since the condition is not inflammatory.

The swallowing of open safety pins seems to be one of the ever present hazards during infancy and childhood. The pin usually passes through the esophagus fairly readily but may lodge behind the cricoid cartilage, and it may be necessary to push it gently down into the stomach.[71] Its further passage is usually assisted by feeding of fibrous foods, but a suggestion which will be welcomed by distracted and anxious mothers is that small bits of cotton, teased into fine shreds, be mixed with the food during the next day or two. The pin is passed in five or six days, completely encased in a protective cotton envelope. If the pin passes into the trachea or a bronchus, the services of a bronchoscopist are necessary.[72] The removal by bronchoscope of a foreign body may be followed by the production of a considerable amount of viscid mucus.[73] A case is reported in which there developed an irritative cough for which morphine

was prescribed. Within twenty-four hours a complete atelectasis of the affected side occurred from the accumulation of mucus as a result of the inhibition of the cough reflex. The morphine was discontinued, but the accumulation of mucus necessitated the use of the bronchoscope for removal.

Aspiration of foreign bodies or of infected material following tonsillectomy occasionally results in lung abscess, or even gangrene of the lung. The infecting organisms may be bacteria, fusospirochetes or fungi.[74] The appropriate treatment should be determined by careful bacteriologic study. If the condition is due to infection by the gas bacillus, specific or polyvalent serum should be used; if due to staphylococci, polyvalent staphylococcus antitoxin; if due to fungi, increasing doses of potassium iodide; and in fusospirochetal infection arsenicals are best, the dosage being half the amount that the child would require for the treatment of syphilis. General treatment for all types of infection consists of rest in bed, forced fluids, high vitamin diet, postural or bronchoscopic drainage, and, if the condition persists over three months, open incision and drainage. Immobilization by cutting the phrenic nerve should not be considered because contraction may block a bronchus and prevent drainage. Artificial pneumothorax and diagnostic puncture are also contraindicated on account of the danger of producing a putrid empyema. When putrid empyema has occurred as a complication of cortical lung abscess, protective pleural adhesions have usually formed, and the mediastinum has become stabilized so that rib resection may be performed with safety. Early operation is desirable particularly where anaerobic bacteria are present as they have a tendency to liquefy adhesions causing a rapid spread of the infective process. Great care must be exercised not to infect clean pleura, for this, or contamination of a needle tract following diagnostic puncture, may be followed by a fatal extension of the infection. Free access of air by thorough unroofing of the cavity is essential when gas bacillus infection is present.[75]

Purulent bronchiectasis, which occasionally begins in childhood, may not be disabling or tend to shorten life, but it may cause a serious social handicap on account of the terrifically malodorous sputum.[76] Treatment of this condition by lobectomy has been recommended; but since it frequently yields to medical measures, an operative procedure which is attended by a 40 per cent mortality is not to be considered a method of choice.

The relative merits of the open and closed methods of treatment of empyema are still being considerably discussed, but fortunately there seems to be a general recognition of the fundamental principles upon which treatment should be based. Most observers are in agreement that nothing should be done before the mediastinum has become stabilized, the pneumonic process has subsided, and the pus is under positive pressure. With agreement upon these points, the results of the two methods of treatment seem about the same. In one analysis of 310 cases[77] twenty-three cases treated by aspiration alone gave a mortality of 43 per cent, as contrasted with a mortality of 12.5 per cent under rib resection. It is possible that a careful study of these cases would show that those in which aspiration alone was used were seriously ill and were poor surgical risks. Thorough cleaning of the empyema cavity under direct vision by wiping with gauze would seem to involve an

unnecessary amount of manipulation[78] although good results are reported, there being two deaths among nineteen children. When the method of closed drainage is used, it is generally recognized that it does not remain closed after the fifth day, and every attempt should be made to induce the expanding lung to reach the chest wall by that time. This type of drainage may be instituted as soon as the pus is under positive pressure, earlier than rib resection is advisable. If roentgenography shows that the lung is completely expanded by the end of the fifth day, obliterating the empyema cavity, the tube should be removed and dry dressings applied. Residual abscesses or recurring collections of pus occasionally require drainage, but on the whole the results by this method of treatment are surprisingly good. For determining the obliteration of these cavities by roentgenography, a very thin emulsion of lipiodol is recommended.[79] Barium paste should not be used because of the difficulty of removal, and sodium iodide may cause poisoning if there is a large absorbing surface.

If the resistance is low and it is desirable to stimulate specific antibodies, autopyotherapy has been tried.[80] The treatment consists of the withdrawal of pus from the empyema cavity, and reinjection subcutaneously in amounts varying from 0.5 c.c. to 10 c.c. This was occasionally followed by a reaction consisting of elevation of temperature lasting in some cases as long as twenty-four hours. Two or three injections were given at intervals of two to three days. One patient, however, received injections varying from 1 c.c. to 10 c.c. at intervals of two to ten days for a total of 60 c.c. Of ten patients so treated, seven recovered, the recoveries being rapid and striking in two cases and entirely satisfactory in the other five. All patients were seriously ill. Of eleven patients treated by repeated puncture, serum, and general medical treatment, six died, and four of the survivors apparently needed rib resection. No mention was made of the occurrence of subcutaneous abscesses as a result of the treatment.

Intrathoracic tumors may develop without causing symptoms, the condition being discovered accidentally during roentgenography for some other condition. Many such tumors are benign and may be removed surgically. Thorough roentgenographic study is advisable to show the exact relationship of such tumors to the surrounding structures; and, as the condition is usually not an emergency, the examinations may extend over a sufficiently long period to permit an estimation of the rate of growth. Especially to be mentioned are lymphoblastomas. These are not amenable to surgical treatment but are definitely radio-sensitive and easily reduced by roentgenotherapy. Diagnosis usually depends upon the therapeutic test because the shadow will definitely diminish within three to five days following the first treatment.[81]

Gastrointestinal symptoms and convulsions in an infant of two months would not ordinarily call for a roentgenogram of the chest, but a search for the cause of a beginning dyspnea disclosed a mass in the superior mediastinum.[82] Observation over a period of three weeks showed a steady increase in the size of the shadow and the mediastinum was opened by excising a portion of the third costal cartilage with the evacuation of a considerable amount of pus. There was prompt healing and relief of symptoms. Observation over a period of one year

showed good healing and gain of weight with, however, a marked depression of the sternum and costal cartilage which could not be corrected.

GENITOURINARY CONDITIONS

The diagnosis of urologic conditions in infants and young children is difficult because subjective symptoms are usually unreliable, because physical examination is often unsatisfactory, and because acute abdominal symptoms are usually ascribed to inflammation of some abdominal structure.[82] In general the methods of diagnosis are the same as in adults, but a knowledge of the psychology of children and the ability to handle them are essential if accurate conclusions are to be reached with a reasonable expenditure of time and effort. If gentleness is used, children tolerate well such instrumentation as is necessary for cystoscopy and ureteral catheterization; both excretory and retrograde urography are valuable diagnostic measures. In the presence of acute abdominal symptoms such as rigidity, tenderness, intermittent pain, and fever, examination of the urine for blood and pus cells should never be neglected. Dysuria, incontinence, or enuresis may be due to vesical calculus, in which connection it is to be noted that a diet high in vitamin A is reported to have distinct prophylactic value. Persistent pain and tenderness in the kidney region, most marked in the morning, is suggestive of an aberrant renal blood vessel. There may be gastrointestinal symptoms, and the pain is usually dull rather than colicky. Megaloureter, which is to be distinguished from a dilated ureter, is usually congenital and thought to be due to neuromuscular dysfunction. The wide ureteral orifice allows reflux infection, and the prognosis is poor. Dilation of the ureter may be caused by kinks or strictures, the characteristic symptoms being chills and fever with varying degrees of pain and tenderness, usually accompanied by pyuria. Marked dilatation of the kidney pelvis and ureter may be caused by ureteral kinking due to renal ptosis.[84] If the condition is recognized early, before kidney destruction has taken place, plastic surgery on the pelvis or ureter may save the kidney. Excretory urography is of particular value in small infants and children, but it must be used as a supplement to other means of diagnosis. In one series of 304 cases it was of diagnostic value in only 47 per cent, but in 7 per cent it was sufficiently accurate to render other diagnostic measures unnecessary. It is unreliable when the functional activity of the kidney is low or when the normal power of concentration is absent.[85] A new iodine compound for this purpose is hippuran, which is nontoxic and is excreted unchanged. It may be used by the intravenous, subcutaneous, or oral routes of administration. Excretory urography is of value in the differential diagnosis between perinephritic abscess and a retrocecal appendix, a normal urogram being strongly suggestive that the condition is due to the appendix. It may also be of value in the diagnosis of retroperitoneal tumor since the retroperitoneal space is so limited that a tumor in that region will cause displacement of the kidney or a ureter, whereas a tumor in the peritoneal cavity will not.[86]

Renal tumors are the most frequent cause of painless enlargement of the abdomen in infants and small children,[87] and because of this characteristic they have usually reached the metastatic stage before diagnosis is made. In many instances the tumors contain embryonal cells and hence are radio-sensitive. Following irradiation, recession of

the tumor is often striking, but the relief is only temporary, recurrence being the rule under both irradiation and surgical treatment. Complete recovery is occasionally reported, therefore all measures which seem to promise relief are worth trying. Neuroblastoma[88] is a tumor of the sympathetic nervous system occurring in the suprarenal medulla. It shows a marked tendency to recur after surgical removal even though it is usually well encapsulated. Metastases to distant points are frequently seen. No operation should be performed upon a kidney without a thorough renal study to determine the functional activity of the opposite side, as the solitary kidney is particularly susceptible to disease.

A tendency to recurrence is not characteristic of tumors of the testis, a malignant teratoma being reported in an infant eleven months old.[89] Enlarged inguinal lymphatics, present after the testis was removed, disappeared under irradiation and had not recurred after the lapse of nine years.

A history of urinary dribbling of long-standing should suggest a diverticulum of the bladder. Such a condition is usually associated with residual urine and cystitis. Diagnosis is easily made by cystography or cystoscopy.[90] Careful search should be made for other congenital abnormalities such as urethral valves or an aberrant ureter opening below the vesical sphincter.[91] The existence of such an aberrant ureter may be verified by filling the bladder with dye and noting that the urine which continues to dribble is clear. Careful renal study gives accurate information as to the position of the aberrant ureter, and it may be removed surgically. Valvular obstructions in the urethra are usually congenital and occur as ridges, folds, or perforated diaphragms. The common symptoms are pyuria, some disorder of urination, occasional distention of the abdomen, and loss of weight.[92] The valvular obstruction may interfere with the outflow of urine but still not present an obstruction to catheterization. Cystography usually permits accurate diagnosis. Obscure symptoms, coupled with failure to gain, are sufficient indications for a careful renal study, even in small infants in whom there are no apparent urinary difficulties.[93]

The association of spina bifida with urinary abnormalities, particularly incontinence and enuresis, has often been noted. This condition, however, can be considered to have a causal relation only when extensive or when there are such associated conditions as defective sensation in the lower limbs, club feet, or areas of hypertrichosis on the back.[94] A roentgenologic study of a large number of normal children indicates that 54 per cent have some degree of spina bifida occulta; and, while a slightly higher percentage of children with enuresis show this anomaly, the difference is not great enough to be significant. The occurrence of such a high percentage of spina bifida occulta in normal children is somewhat surprising, and a recheck of these same children would be interesting made at a sufficiently distant time to have permitted a possibly delayed ossification to have taken place.

The treatment of hypospadias presents difficulties which tax the skill of the best plastic sugeon.[95] The repair requires several stages extending over a period of some four to six years, it being advisable to complete the course by the age of nine. Operation upon the glandular type is not considered necessary. In other types the first operation corrects the curvature of the body of the penis by excision of all fibrous tissue from

the normal site of the urethra. This should be done early, preferably before the age of two years. Some three or four years later, the construction of a urethra may be begun. The parallel flap method gives a urethra most nearly approaching the normal as it does not include hair-bearing skin. The pedicle flap method requires the special skill of a plastic surgeon. The scrotal flap method and the Ombrédanne type of operation both include skin which contains hair follicles. The immediate results from these operations may be good, but the growth of hair may result in the formation of concretions and fistulous openings from ten to fifteen years later. Except when the Ombrédanne type of operation is used, the diversion of the urinary stream either by suprapubic or perineal drainage is essential.

The operation of circumcision is in reality a plastic procedure, and the bizarre results often seen would indicate that many of the methods used lack most, if not all, of the essentials of good surgery. To overcome some of the commonly encountered difficulties, a method is described[96] in which the prepuce is drawn through a longitudinal slit in a metal plate, held at an angle parallel to that of the corona. After the excess skin has been removed, the mucosa is trimmed to within one-fourth of an inch of the corona and its edge united to the edge of the skin with catgut stitches. Another operation which is not a true circumcision but which relieves the condition of phimosis by a plastic enlargement of the preputial orifice consists of a straight incision through the skin of the dorsum of the prepuce to the mucocutaneous junction. A triangular incision is made in the mucosa with its apex at this point. The triangular flap is thoroughly undermined and the apex of the flap is united to the proximal end of the straight incision. This procedure may be varied by making the straight incision on the mucous surface and the triangular incision on the skin surface.[97] This operation would not appear to meet the requirements of cleanliness as well as the other type of circumcision.

One of the generally accepted reasons for placing the undescended testicle in the scrotum has been the danger of malignant change.[98] This has been questioned, a study of the literature having shown a wide variation in the percentages of malignancy reported. It is concluded that no substantial facts have been presented to indicate that the undescended testis is more susceptible to malignant change than the normal testis, and hence that its removal for that reason is not indicated. The normal scrotal position of the testis, however, is necessary for spermatogenic function as has been definitely proved by experimental study.[99] If the testicle is maintained constantly at normal body temperature, spermatogenesis does not take place and exposure to a temperature from 5° to 7° C. above body temperature for a period of twenty minutes will cause marked testicular damage. If the testicle is placed in the normal position, even after apparently hopeless degeneration has existed for a period of five months, normal function is recovered within three months. This condition in experimental animals has been considered to be roughly equivalent to the scrotal implacement of an undescended testicle in a man of twenty to twenty-five years of age. These studies would seem to indicate that it is not necessary for the testis to be in the scrotum by the age of puberty. It will be interesting to follow the clinical application of these findings.

When surgical treatment is indicated, the Torek operation continues to maintain its position of deserved popularity. As conditions in which

surgical treatment is not indicated may be mentioned those few cases in which descent will normally occur about the age of puberty;[100] those in which nondescent is due to endocrine disturbance, in which surgery is of no value; and those in which descent will occur under the stimulation of pituitary therapy if there is no mechanical obstruction. The results of treatment by pituitary hormone are variable,[101] some testicles descending completely and rapidly, others only partially, and others showing little change in position. Failure to descend is ascribed to a mechanical obstruction or to some vitamin deficiency. It has been observed, however, that the testicles always increase in size. In a case of endocrine imbalance exhibiting the Fröhlich syndrome,[102] an abdominal testicle emerged after the sixth treatment with the pituitary hormone isolated from pregnancy urine. This treatment was supplemented with thyroid extract and pituitrin with marked mental and physical improvement, complete descent of one testicle, and partial descent of the other. The treatment was continued over a period of about five months. If testicular descent is unsatisfactory following a reasonable trial of the pituitary hormone, surgery is advocated and is advisable.

ORTHOPEDICS

It is encouraging to note the increasing emphasis which is being placed upon the fact that certain conditions are peculiar to children and that conclusions based on observations on adults frequently cannot be made to apply to children.[103] The widespread recognition and acceptance of these and similar observations will necessarily produce better results from the surgical treatment of conditions peculiar to children. Pathologic conditions and the reaction of bones and joints to pathologic conditions vary with the different age periods of childhood.[104] The bones of infancy and early childhood are characterized by a greater vascularity and a looser structure than those of a later age, making them more subject to hematogenous infection and consequent destruction. They are more plastic and yield more readily to strain or pressure, but, on the other hand, they have greater possibilities of growth and repair following disease or injury. The common traumas of childhood no doubt have an etiologic significance in bone lesions. Osteomyelitis is common, the sclerosing type being particularly resistant to treatment and subject to recurrences. General body resistance is in most instances fairly good, which may account for the fact that tuberculous and septic joints are usually monarticular and that it is the exception rather than the rule to see multiple bone lesions due to infection. The adolescent period is characterized by lesions affecting the epiphyseal regions, such as Osgood-Schlatter disease, coxa plana, coxa vara, and the juvenile kyphosis of adolescence. Roentgenographic studies are of special value, but it is essential that interpretation be based upon an accurate knowledge of the normal appearance of bones and joints at the various stages of growth and development. A failure to appreciate the physiologic factors of growth and development will often result in serious and even disabling deformities following surgery affecting the epiphyseal regions.[105] Fractures, osteomyelitis, and bone grafts may cause delay or cessation of growth on one side of an epiphysis with a relative overgrowth of the opposite side or retard the growth of one limb with the relative overgrowth of the opposite one. An especially striking example of this occurs in fractures of the external condyle of the humerus in which

removal of the fragment is frequently followed by varying degrees of ultimate deformity. Careful replacement should always be attempted as excision can be done at any time, and no new epiphysis with the power of growth can ever be substituted after it has once been removed. Prolonged observation is advisable in evaluating the results of this fracture and reports of good results at the end of two years may be completely reversed five years later.

During infancy infections of bones and joints are definite sequelae of the acute respiratory infections. Continued or increasing elevation of temperature together with a disinclination to move or be moved should always indicate careful examination of the extremities for muscle spasm, limitation of motion, tenderness, and swelling. Early examination is essential as valuable diagnostic points may be obscured by the extension of the process. In joint infections the swelling occurs first over the joint, in osteomyelitis over the diaphysis. With joint involvement, even the most gentle motions are resisted, differentiating this condition from early osteomyelitis. Gentle palpation will distinguish a soft tissue abscess from a bone or a joint infection. Septic joints should be treated by early incision, whereas the other conditions should be allowed to localize. Particularly is conservative treatment to be recommended if there is malnutrition or dehydration, the indication being to treat the general rather than the local condition. Under the age of two years, prognosis is better than later. In osteomyelitis it may be unnecessary to open the bone, simple incision of the periosteum with drill holes through the cortex being sufficient. After localization of soft tissue abscesses, incision and drainage are followed by rapid recovery. The choice of time for operation is particularly important, and extensive or poorly timed surgery is often followed by serious consequences. Fulminating osteomyelitis is always serious, and the prognosis is bad under any kind of treatment.[106]

Osteomyelitis of the maxilla in infants and nurslings is always a serious condition. Its occurrence has usually been ascribed to trauma incident to the usual cleansing of the mouth and gums. It will relieve the conscientious mother and nurse to know that a careful histologic investigation has shown that this is not always the case.[107] It may be secondary to an infection in the nasal cavity or sinuses, the soft tissues being first involved. It may also be secondary to a distant infection, following which the maxillary involvement develops first in the bone marrow.

Osteomyelitis is primarily a disease of childhood and youth, and the seriousness of the condition should be more widely appreciated. The period of disability is long, causing financial and economic distress both to the individuals and families concerned and to the hospitals which are often burdened with nonremunerative cases. Results are often unsatisfactory, functional disturbances and crippling deformities being comparatively frequent. In view of the seriousness of this condition there should be more general knowledge among the laity regarding the early symptoms[108] and the necessity of medical care when there is a persistent or unaccountable pain in any of the extremities. All cases are not surgical emergencies, some requiring careful medical preparation before the period of election for surgery. The onset is usually sudden with fever, a high blood count, and local pain and tenderness over the end of

the long bone. No true joint symptoms are present at the onset. A test which is almost diagnostic is the production of pain at the site of infection, when the opposite end of the bone is tapped.

Opinions as to the proper operative procedure vary, complete diaphysectomy being advocated on the one hand and more conservative measures of drainage, on the other. Diaphysectomy[109] removes completely the infected or necrotic bone. Adequate drainage is easily established, and whatever sequestrums may form subsequently are easily removed or are spontaneously extruded. The removal is subperiosteal, and it is claimed that the newly formed bone is more solid, is more regular in shape, does not contain infected cavities and that the course of the disease is distinctly shortened. The maintenance of extension is necessary during the healing process to prevent shortening due to muscle contraction. At the time of operation special care is necessary to avoid damage to the epiphyseal line. The regeneration of new bone may be surprisingly rapid and complete, a case being reported in a child, aged six years, in which the roentgenogram showed extensive new bone formation six weeks after removal of the entire tibial diaphysis, with complete return of function in six months.[110] About three years later, due to a recurrence of the condition, the diaphysis was again removed. The shape of the bone was somewhat irregular but in general showed normal markings and had grown in proportion to the growth of the child. Secondary complication required amputation ten weeks later, when a fairly good shaft of osteoid tissue had already developed.

The advocates of more conservative measures recommended incision of the periosteum with drill holes or small openings through the cortex of the bone, with removal of the diaphysis only if it has become definitely necrotic. The removal of the diaphysis and the gutter operation, as standard procedures, are considered as productive of unnecessary shock. Localization of a general infection in a bone is thought to be due to the presence in the bone marrow of a large amount of reticuloendothelial tissue and by the removal of this tissue in diaphysectomy the body's defense mechanism is correspondingly reduced. Conservative treatment includes immobilization of the joints above and below the affected bone, thorough drainage with infrequent dressings, treatment of the general condition with a nutritious diet high in vitamin and fluid contents. If a sequestrum develops, it may be removed in six to eight weeks. If the response to treatment is not satisfactory within two or three days, the specific resistance in staphylococcic cases may be improved by transfusion of immunized blood from a donor who has been prepared by injections of staphylococcus vaccine. Stock staphylococcus serums have been found to be of no benefit.[111] The use of stock serums, also, in the treatment of streptococcic infections of bone has not been productive of good results, but satisfactory improvement has been noted following the use of a specially prepared antistreptococcic serum of high potency, which has been made and distributed under the supervision of the New York State Department of Health.[112] The occurrence of chronic osteomyelitis has been attributed to the absence of adequate blood supply to certain portions of the bone, and it has been possible to stimulate this in some instances by drill holes connecting the poorly nourished portion with normal bone and by cutting channels connecting the good with the

poorly nourished bone.[113] It is thought that new blood vessels follow these avenues, and observation from one to two years after operation shows continued good results.

Fractures near the wrist show a definite variation during different age periods.[114] Green-stick fractures characterize the early ages; in later childhood folding fractures with compression occur; slightly later, but still before puberty, there may be transverse or even green-stick fractures. Puberty is characterized by epiphyseal separations, and after puberty appears the usual adult type of Colles' fracture. The treatment of fractures of the femur by Russell traction has attained a well-deserved popularity. The originator of this method was thoroughly familiar with the laws of physics governing the resultant of two forces acting at an angle, and the disagreement in results, reported by various observers, may perhaps be explained by a failure to appreciate these basic principles. The direction of the resultant of two such forces can always be definitely determined by measurement of the angles at which these forces act, and this resultant should always be in the direct line of pull of the femur.[115] It should be unnecessary to call attention to the fact that an accurate knowledge of the basic principles of any method is essential to the production of best results.

Adolescent kyphosis[116] is a gradually progressive condition due to hernia of the nucleus pulposus of the intervertebral disc combined with epiphysitis of the upper and lower edges of the bodies of the vertebrae. There is usually a compensatory lordosis above and below the kyphos which may be slightly painful. The cause of this condition is vague, a suggestion of some nutritional defect involving epiphyseal development having been made.[117] The bodies of the vertebrae gradually become wedge shaped. The progress is so gradual and the symptoms so few that the condition is usually first noted by some one other than the patient. No cause for this condition being known, there is, of course, no prophylactic treatment, all measures being directed toward prevention of the increase of the deformity. This involves rest in bed over a long period of time, or the use of a plaster shell with hyperextension. No definite indications are given as to when the process may be considered arrested and the patient permitted to be about with a back brace. This condition is not to be confused with kyphosis due to congenital fusion of the spine,[118] which develops gradually during childhood. The condition is painless and not accompanied by signs of infection. No treatment is recommended.

Decision to use radical or conservative treatment in tuberculosis of the spine will depend upon the location and extent of the destructive process.[119] In general, lumbar and cervical lesions may be expected to respond well to conservative treatment, whereas thoracic usually require fusion. Whenever the tip of the spinous process can be felt to move under firm palpation, fusion will be necessary, as conservative treatment will not halt the progress of the disease. Conservative treatment involves recumbency on a frame or in a plaster shell in a position of hyperextension, with head traction in cervical cases. Unless treatment is begun very early, no reduction of the kyphos may be expected, but further progress is stopped. The period of treatment is usually about three years. All of the general antituberculosis measures are to be used. If a cervical abscess shows a tendency to point, it is better to use aspiration rather than incision. Dorsal abscesses occasionally give rise to pres-

sure symptoms, but they seldom point, and it is usually unnecessary to open them. Psoas abscesses point in the groin, flank, or thigh and, if they become secondarily infected, run a protracted course with symptoms of sepsis. The Hibbs type of fusion, with the addition of an osteoperiosteal graft, is recommended when surgical fixation seems desirable. The patient should be in excellent condition, all evidences of the acute process having subsided and the roentgenogram showing a tendency to heal. Fusion before the age of five is possible under exceptional conditions but is not recommended. If at any stage of the conservative treatment the deformity tends to increase, fusion is advisable. Excellent and good results may be expected in over 60 per cent of the cases when the type of treatment is based upon a careful study of the individual conditions and indications.

Many joint conditions occurring at the age of adolescence are of a vague etiology and are poorly understood. Certain of these may be grouped under the general term of osteochondritis juvenilis.[120] An appearance of fragmentation of the epiphysis is characteristic of most of these, and there may be associated lesions in the adjacent parts, for example, in Legg-Calvé-Perthes' disease the acetabulum may present an appearance of fragmentation and the trochanter and diaphysis be affected. A similar condition may occur in the shoulder or knee. Associated with Osgood-Schlatter disease may be abnormalities of the tibial epiphysis and patella, the latter being occasionally referred to as "partite patella," or the patella of one leg and the tibial tuberosity of the other may be involved. If local pain and tenderness occur in any of these locations, careful examination of other joints is indicated.

Reports of slipping epiphysis of the femur are appearing with increasing frequency.[121] The condition is variously and vaguely ascribed to some endocrine disturbance, increasing weight with a minus basal metabolic rate, a change in the inclination of the epiphyseal line incident to growth, or to trauma. The fact that it may occur from so slight a cause as turning over in bed would indicate a definitely abnormal condition of the epiphyseal line and roentgenograms in the earliest stages before symptoms have developed may show a widening and irregularity of these lines. The slip may be complete or incomplete, sudden or gradual, with pain in the region of the hip occasionally extending down the leg, usually dull in character, often intermittent and accompanied at times by spasm of the hip muscles. When the slip is complete, the leg lies in a position of flexion, abduction, and external rotation, and there is marked disability. When it is partial, symptoms may extend over several months causing only moderate limp and discomfort. Various treatments are recommended, manipulation and fixation in plaster in a position of abduction proving effective in early cases. Traction in bed at times is all that is necessary. In cases in which the slip has existed for a period of six or eight weeks, open operation with replacement and fixation of the epiphysis is usually necessary. Results are variable and not particularly satisfactory, there being frequently a shortening of the leg with a certain amount of limitation of motion. The period of adolescence would seem to be a somewhat neglected zone, just beyond the domain of the pediatrician, in which many of the factors influencing growth and development are perhaps poorly understood; and, although most of those who enter the zone pass through it safely

if meddlesome interference can be reduced to a minimum, it is a field in which careful, scientific investigation will be welcomed.

A condition somewhat resembling slipping epiphysis is congenital coxa vara.[122] The appearance is somewhat suggestive of fracture of the neck of the femur. The epiphyseal line is vertical, the greater trochanter elevated and the head depressed. To produce a fracture of this character, severe trauma is necessary in an infant, and such history is never present. The condition tends to progress, finally resulting in marked deformity and disability. Conservative treatment is ineffective, and an increase of the blood supply to the epiphyseal line by drilling across it is recommended, the object being to produce ossification. This may be done at any time after the age of three years, the earlier the better; a secondary operation after ossification has occurred may be necessary to correct the coxa vara.

In an excellent symposium on the treatment of congenital dislocation of the hip, there was considerable diversity of opinion regarding the age of election for open operation.[123] In general, open operation is advised earlier than formerly, the age after which manipulative reduction cannot reasonably be expected to give good results being variously estimated at from two to five years. The most rational stand to take upon the choice between the open and closed methods would apparently be that the open method should be used on all cases which do not respond to closed manipulation. Perfect reduction and perfect function have been obtained by both types of treatment. Results, however, must be judged after long observation, because a reduction which has remained perfect during childhood may be followed by redislocation at the age of puberty and require open operation. When operative procedures involve the head of the femur or the acetabulum, painful limp and a certain amount of limitation of motion may be the final result. As has long been known, the poorer results are in those cases treated in the later years of childhood. The operation most in favor is one in which a shelf of bone is turned down to form a roof of the acetabulum, the shelf being held in place by chips from the adjacent bony surfaces or by a wedge taken from the tibia. Some evidence indicates that such a bone shelf finally absorbs but that before absorption takes place the acetabulum has deepened sufficiently to insure stability. The persistence of the Trendelenburg sign does not necessarily indicate that the head of the femur has slipped out of the acetabulum. The more radical advocates of the open operation contend that anatomic conditions are such that closed manipulation can never produce a permanently good effect and that satisfactory reduction is possible only under direct vision. They also call attention to the fact that there is a shorter period of postoperative immobilization. When closed reduction results in a permanently stable hip, conditions are usually more normal than after open operation although excellent results have followed operative reduction in young children.

The treatment of tuberculosis of the hip by extraarticular fusion has attained definite recognition. In an analysis of 170 cases,[124] the first operation failed in about 31 per cent. The results following the second and third operations were better, the failures being only 12 per cent, and were considered to be due to faulty technic or poor immobilization. The results of fusion before the age of five years were not so good as in older children and the advisability of operating on children under the

age of nine years was questioned. As in all tuberculous lesions of bones or joints, it is necessary to use all the tried and proved methods for the treatment of the general condition before surgery is attempted, the condition in the joint being but a local manifestation of the general condition.

It is generally conceded that the treatment of congenital malformations of the foot should be begun at the earliest possible time. For the treatment of equinovarus[125] early and repeated manipulation is the method of choice. Treatment to be considered satisfactory should result in a complete range of motion and an external rotation of 20 degrees. Proper position must be maintained by aluminum splints or special boots over a period of years. Tenotomy or other open operation is definitely contraindicated in infants. Congenital flatfoot is considerably more difficult to treat,[126] it being contended that extensive bone and tendon operations are necessary and should be performed before the age of nine years. A series of six cases treated by this method shows good results, the children being able to maintain normal equilibrium, walk, run, and wear ordinary shoes. This opinion is at variance with the one that extensive operations on the tarsal bones are contraindicated before complete ossification has taken place, because of interference with growth and a resulting inequality in the size of the feet. Consistent muscle training and support continued through the age of puberty will often give strong and satisfactory feet, and the advocacy of extensive operation before puberty would seem open to question. The treatment of pes cavus[127] has been in many instances rather unsatisfactory. Relapses have occurred frequently, and the condition is somewhat more disabling than flatfoot. A careful study suggests that contracture of the tendo Achilles is not a cause of this condition but that it is due to the dropping down of the forefoot usually associated with weakness of the extensor toe muscles. It tends to progress slowly but steadily during childhood. Operative treatment is not recommended before the age of puberty but in special instances may be done as early as twelve years. It is performed in two stages, the first of which lengthens the inner border of the foot preserving all muscles, and the second maintains the corrected position by transplantation of tendons.

Congenital dislocation of the patella[128] does not usually cause symptoms until the age of approximately eight years, when definite disturbances of locomotion begin to appear. Good results in two cases followed transplantation of the entire extensor apparatus with replacement of the patella in the correct position. A period of postoperative observation of only three and six months would seem too short following an operation of such magnitude. The function at that time, however, was good, and the procedure described seems rational and worthy of trial.

Sprengel's deformity, or congenitally high scapula,[129] is often associated with other congenital bony defects. Surgical treatment has been advocated and is clearly indicated in those cases having a bony connection between the scapula and the thoracic cage. In milder cases where the defect is largely muscular, physiotherapy may be of benefit. Results are not particularly good, a really normal condition seldom being attained.

Volkmann's contracture is always a particularly distressing condition, and any treatment which will give reasonable assurance of its prevention deserves careful conderation.[130] After any fracture of the bones of the

forearm, the patient should be seen frequently, regardless of whether the reduction is being maintained by a cast or splint. If the fingers become cyanotic or motion is definitely restricted by swelling, an incision should be made through the fascia of the forearm. This permits the evacuation of a hematoma or the reduction of pressure due to edema and if done early will prevent the development of this distressing deformity.

NEUROLOGIC CONDITIONS

The necessity of a thorough and accurate knowledge of physiology and anatomy on the part of the surgeon has been often stressed, but nowhere is the importance of such knowledge greater than in the surgery of the sympathetic nervous system. A more accurate knowledge of fundamental facts which have been known by the physiologist and anatomist for many years would perhaps have prevented the failure of the early claims for the relief of Little's disease and certain diseases of the vascular system by sympathectomy. Knowledge of the physiology and pathology of the sympathetic nervous system is still incomplete, and the employment by the surgeon of the critical, unprejudiced attitude usually found in the research or laboratory worker is essential in the development of rational treatment.[131] Through this system the automatic functions of the body are controlled and correlated. We are unconscious of its workings and ignorant of its method of operation; consequently it is difficult to evaluate and determine the symptoms which are caused by its malfunction. The commonest tumor of the sympathetic nervous system is the neuroblastoma. This may occur in the medulla of the suprarenal capsule, as has already been mentioned, or in the trunks or ganglia of the sympathetic nervous system itself.[132] The symptoms are vague and confusing, at times resembling those of acute rheumatic fever with a high temperature and involvement of many joints; there may be anemia with a low platelet count, rigidity, and tenderness of muscles, and multiple small areas of rarefaction in the bones. The course is usually progressively downward in spite of all attempts at treatment or relief. These tumors are occasionally seen in infancy and early childhood and may be present at birth. A peculiar condition, possibly due to some malfunction of the sympathetic nervous system, has been noted in connection with intracranial tumor and with encephalitis following whooping cough.[133] A condition of decerebrate rigidity develops in which there is a constant spastic contracture of the limbs in the position of extension. Such condition may logically be expected to develop when there is interruption of the impulses or nerve pathways from the cerebrum, due either to the pressure of a tumor or to degenerative processes incident to encephalitis.

The value of lumbar puncture and the ease of performance are so great that the necessity of care in its use may not receive sufficient emphasis.[134] If the needle is introduced too far, especially in a position of flexion, there is danger that it may penetrate the intervertebral disc and cause a loss of the nucleus pulposus. This narrows the intervertebral space causing limitation of motion, pain, difficulty in walking and spasm of the lumbar muscles. Progress of the condition is slow, and there may be late destructive changes in the intervertebral cartilages and osteomyelitis in the adjacent vertebrae. While such accidents must be extremely uncommon the possibility of their occurrence must be borne in mind.

Few conditions occur in infancy, the treatment of which is as unsatisfactory as that of hydrocephalus.[135] The usual classification into the obstructive and communicating types is without point, such terms merely relating to the position of the blockage in the spinal fluid pathways. It is better to refer to the external and the internal types, the external being due to an increase in the subdural fluid, and the internal being related to the ventricular system. In the external type the fluid, which is entirely separate from that of the ventricular system, is yellow and comparatively small in amount. The treatment, consisting of repeated fontanel puncture, is reasonably satisfactory and, if instituted early, will save the eyesight which otherwise may be lost. Internal hydrocephalus is usually caused by a blockage of some portion of the ventricular system, and removal of the block is usually impossible. Repeated ventricular puncture is ineffectual and causes an eventual rise in pressure. Decompression also is futile and is followed by a more rapid destruction of the brain in the decompressed area than in other portions. Removal of the choroid plexus is at times of value and should be tried in those cases in which some capacity for absorption is still preserved. In the mild cases in which the balance between absorption and production is nearly normal, satisfactory results occasionally follow the dehydration treatment combined with postural drainage, the upright position being constantly maintained.

Much more hopeful than the treatment of hydrocephalus is the treatment of spina bifida, over half of the cases being suitable for operation with a comparatively low mortality of 10 per cent. Cases showing gross paralysis, hydrocephalus, or the complete absence of a sac are not suitable for operation. When there is a ruptured sac, operation may be performed within twenty-four hours after birth, or at three or four weeks of age. Every attempt should be made to preserve the greatest possible amount of sac, as it has a distinct absorptive function. It should be opened, drained, folded inward and covered with fascia and skin. Suddenly increasing paralysis associated with spina bifida occulta indicates adhesions drawing nerve tissue downward and may often be satisfactorily relieved by operation.

A condition termed "pseudoabscess of the brain"[136] may occur during the course of otitis media. As the name suggests the symptoms are those usually caused by abscess of the brain, such as paralysis, aphasia, choked disc, and evidence of intracranial pressure. Exploration, however, fails to reveal an abscess. If, after appropriate treatment of the otitis media, the symptoms do not disappear in a week or two, exploration of the brain by needle is indicated. Brain abscess is not an emergency, and the symptoms may disappear during this period.

A sound knowledge of neurology is essential in the diagnosis of intracranial tumors,[137] particularly in the child in whom the history is often indefinite and the usual methods of diagnosis difficult on account of lack of cooperation.[138] Symptoms which are always suggestive are a definite change in the disposition of the child, vomiting, headache, and, in infants, enlargement of the head. Diagnosis is often considerably delayed because the vomiting is erroneously attributed to a gastrointestinal disturbance. In some cases there is fever, suggesting encephalitis, and cases of tumors in the region of the third ventricle may run a short febrile course without signs of intracranial pressure.[139] In more than 15 per cent of the cases, the classical symptoms of intracranial tumor are absent, and

it should be remembered that no one symptom is constant. Spinal pressure may be normal, and the spinal fluid may show a normal cell count. There is usually, however, some symptom which may be interpreted as focal. Encephalography is a distinct aid in doubtful cases, but it should not be used routinely as it is not without danger. Death has been reported following ventricular puncture for the purpose of encephalography, and headache, nausea, vomiting, pallor, and convulsions following air injection may persist for four or five days.[140] Headache does not depend on the volume of air used, as a small amount produces the same headache as a large; neither does the variation in spinal fluid pressure influence headache.[141] It is advisable to use more air by volume than the fluid removed since the weight of a column of fluid is greater than that of a column of air and the expansion of air due to body temperature is negligible. Considerable variation in the subarachnoid cisterns exists within normal limits, and proper interpretation requires skill and broad experience.[142] In many cases the procedure is a most valuable aid in diagnosis. In the fixed lesions of childhood, such as the cerebral palsies, spasticities, and mental retardation, encephalography often gives a clear picture of the physical defect but little information as to the cause, the mentality, or the prognosis. An outstanding value in many mental cases is that visual demonstration of an abnormality will often remove doubt from the parents' minds and permit them to plan a definite course for the future care of the child. At times there is a distinct improvement following the injection of air, the reason for which has never been satisfactorily explained. In traumatic cases the assumption has been advanced that the air pressure has relieved posttraumatic headache by favoring the separation of adhesions.[143] Posttraumatic bleeding from the subarachnoid space may often be controlled by the injection of 20 c.c. to 40 c.c. of air with removal of approximately the same amount of spinal fluid.

The development of treatment by dehydration has been the greatest single factor in the reduction of mortality due to cerebral trauma.[144] Dehydration is physiologic decompression, and, when physiologic decompression fails, operative decompression would fail also. Surgery is definitely indicated in compound fracture of the skull, particularly when foreign bodies have been forced into the brain substance; it is also useful in the relief of subdural and epidural hemorrhage, and for drainage of the wet brain. Subtemporal decompression, however, in cases showing bloody cerebrospinal fluid, is inevitably fatal. In general, all surgical treatment should be delayed until the acute reaction of the brain has passed, and during this time dehydration is of greatest value. For proper dehydration it is essential to give most careful attention to all sources of fluid intake as the treatment includes not only the withdrawal of fluid from the body, but also the prevention of entrance. During the period of dehydration, preliminary to operation, a careful record of temperature and blood pressure is necessary, readings being recorded every fifteen to thirty minutes. The institution of the dehydration treatment, following trauma, is indicated when the pulse pressure approaches the pulse rate. It is to be remembered that the object of all treatment is to prevent obstruction of the venous exits from the skull and to supply a proper amount of blood to the brain.

MISCELLANEOUS CONDITIONS

Pilonidal Sinus.—The condition called pilonidal sinus has been also variously termed "sacral dermoid" or "sacrococcygeal sinus or cyst." It begins during childhood as a midline dimple[145] gradually growing deeper and being visible externally as a small circular orifice. It rarely produces symptoms and may escape detection until the adolescent period or later when a low grade, secondary infection may develop. The sinus varies from 1 to 5 cm. in depth, usually ending at the sacrococcygeal joint and may be attached by fibrous tissue to the bone but not penetrating it. It is thought to represent a vestigial skin appendage[146] and should not be confused with the embryologic cell rests which occur in the vicinity of the coccyx and give rise to large cystic or solid tumors. Removal during childhood is advisable, complete excision being necessary, at times including the periosteum of the bone. Healing by granulation is considered preferable to excision with primary closure on account of the danger of infection.

Burns.—The primary cause of the mortality of burns is largely concerned with blood concentration.[147] Experimental work has shown that dyes pass readily from the blood to the burned area but that they do not pass readily from the burned area into the blood and that, when the burn covers one-sixth of the total body area, a fluid loss equal to 75 per cent of the total blood volume may occur within twenty-four hours. Any concentration of the blood 25 per cent above normal is dangerous, and 40 per cent above normal causes death within a short time. The tannic acid treatment has markedly reduced the mortality of burns because of its control of fluid loss and blood concentration, and its value is so great that it has become a generally recognized method of treatment. A modification of this treatment, for obtaining more rapid action, consists of the addition of silver nitrate.[148] The usual antishock measures are employed as in the ordinary tannic acid treatment. All blebs and loosened skin are removed. Five per cent tannic acid solution is applied freely to all burned areas, one application usually being sufficient to produce drying. Any excess solution may be removed by touching with gauze obtaining a temporarily dry surface. During this short dry period the entire area is immediately sponged with a 10 per cent solution of silver nitrate. This blackens the tissues at once, makes a firm dry covering and does away with the necessity of repeated applications of tannic acid. Blood concentration and loss of tissue fluid are immediately stopped. Blebs, which occasionally form within twelve to twenty-four hours after the first treatment, are similarly treated. All other treatment is the same as advocated with tannic acid. The advantages of the combined use of tannic acid and silver nitrate are that the patient is quickly carried past the most critical hour, gaining twenty-four to thirty-six hours over the treatment by tannic acid alone, and the healing of the burned area is more rapid, shortening the period of hospitalization and simplifying nursing. The method appears to have no disadvantages and offers a slight but distinct advantage over the already excellent tannic acid treatment. In the treatment of second degree burns it has been suggested that under gas anesthesia the burn and the adjacent skin be scrubbed with a soft brush and tincture of green soap, followed by alcohol and ether before the application of tannic acid.[149]

About 60 per cent of burns so treated remain clean beneath the tanned area. An aqueous solution of 1 per cent gentian violet has a greater bactericidal effect than tannic acid and may be used to paint the edges of the tanned area to prevent the infection of any new blebs which may form. Unless the burned area is thoroughly cleaned and infection reduced to a minimum, the tannic acid treatment loses much of its value. It has been recommended at times that the burned area be exposed to ultraviolet light, with the view to reducing infection, but it has seemed that in certain instances keloid formation is favored by such procedure. In case of chemical burns which are more frequently seen in recent years on account of automobile accidents, it is important that chemicals should be first removed by thorough washing with water.[150] The value of this procedure is self-evident, but it is a point which may easily be overlooked in the excitement of the moment.

Cleft Lip and Palate.—The outstanding characteristic of the skeleton of complete bilateral cleft lip is a marked projection of the intermaxillary bone due to the elongation of the vomer.[151] The premaxilla normally bears four incisor teeth but the two laterals are lost early because of poor blood supply. In unilateral cleft lip, the septum usually presents a marked deviation toward the side of the cleft. A report of three cases of bilateral cleft lip[152] stresses certain underlying principles. Among these are: that no bone work should be done on the premaxilla or septum, that early operation as soon as the child has regained its birthweight is advisable, and that the lip should be united in three layers, the prolabium being trimmed and the lateral halves of the lip united symmetrically around it. Sedation and postoperative support for several days are necessary. By following the methods and principles outlined, it is suggested that the surgeon who has had little experience in these cases, or who is not familiar with plastic surgery, may obtain good results. With some of these statements we find it impossible to agree. The details of treatment will of necessity vary with the individual operator, but these must be based upon a thorough fundamental knowledge of the anatomy and physiology of the parts involved, the principles and details of plastic surgery, and most of all upon a broad experience. A characteristic which is often noted in surgeons who have had the greatest experience in the treatment of this deformity, is an attitude of humility when approaching the problems involved in the repair of bilateral cleft lip. A repair which is reasonably satisfactory one year after operation may be so altered by dentition and the forces of physiologic growth and development that the appearance at the age of puberty is grotesque and the surgeon becomes aware of his failure to recognize the power of these forces too late to prevent a deformity which may impose a social and economic handicap that remains throughout life. It is extremely doubtful whether a surgeon who has had little experience in similar cases or who is not familiar with plastic surgery will be able to obtain consistently good results after reading a description of technic. In closure of the soft palate, the preservation of good muscular power is essential to proper speech. In addition to good muscular power, there must be proper length of the palate,[153] and this is prevented by contraction from raw areas healing by granulation. When the palate is too short, it may be lengthened by using the pillars or by flaps taken from

the cheeks; and in later childhood or early adult life, the push-back operation[154] may so lengthen the palate that a marked improvement in speech is possible.

Hemophilia.—With the reporting of more widespread and careful observations, it is becoming increasingly evident that some of the former ideas regarding hemophilia must be subjected to revision.[155] It is not safe to place absolute reliance on the formerly accepted fact that the condition is transmitted through the female line to the male line, for this relationship may at times be reversed, and the tendency to bleed appear in the female.[156] The condition may also occur sporadically[157] which no doubt may be partially explained by the difficulty of obtaining adequate and accurate family histories. The scientific fact that a tendency to hemorrhage may not conform exactly in the finest details to a true hemophilia is decidedly overshadowed in the mind of the surgeon by the fact that the condition exists, and his immediate concern is the problem of stopping or preventing hemorrhage. It is of particular importance to him that the disease is subject to remissions during which the diet should be high in protein, gelatin, and vitamin D, and necessary elective surgery should be undertaken. The fact that a number of different types of treatment have been used with apparently good effects is an evidence that the underlying cause is but imperfectly understood. In the treatment by serum, the patient should always be tested for sensitivity, as generalized reactions are to be avoided and anaphylactic shock may be fatal. Serums other than horse serum may be used, such as sheep or hen serum. The recent intensive studies of endocrinology have brought out statements that hemophilia in the male may be successfully treated by the use of female sex hormones, either as ovarian extract or theelin, and the intramuscular injection of blood from a pregnant or menstruating woman is said to have good effect. The treatment which is generally accepted as having the best results and being applicable to the greatest number of cases is the use of blood by any one of several different methods. Probably easiest in case of emergency is the reinjection intramuscularly of 15 c.c. to 20 c.c. of the patient's own blood. The immediate effect is excellent, and it remains considerably longer than that following the use of transfusions. Paradoxical effects are sometimes reported,[158] as for example the fact that citrated blood improves the coagulation time in hemophiliacs. Both whole and citrated blood seem to be effective, however, and the improvement from blood transfusions lasts from three to six days. For transfusion it is advisable to use a fine needle and to follow with prolonged pressure over the point of injection to avoid the occurrence of a hematoma. Intraperitoneal blood is good, but its effects are too slow to meet hemorrhagic emergencies. In the final analysis it is to be remembered that the test of any measure is the production of hemostasis rather than the change in coagulation time. For local applications pressure with gauze saturated with fresh serum or other hemostatic substance may give temporary relief.

Infections.—It is impossible to overemphasize the danger of acute spreading infections of the hand[159] or face and the necessity for the accurate knowledge of the anatomy of the parts involved and the highest degree of skill in determining the appropriate treatment. Infections of the hand accompanied by red lines extending up the arm are particu-

larly dangerous, and the mortality may be as high as 30 per cent, the survivors being practically always those in whom conservative treatment was used. Cauterization or sterilization of the local wound is illogical and usually ineffective on account of the fact that dissemination of the infection occurs through the lymphatic system, usually beginning within thirty seconds and reaching a point 6 inches distant within five minutes. The earlier that effective conservative treatment can be begun the better, a delay of twenty-four hours often being serious. Absolute rest of the parts, voluminous hot dressings, and measures to improve general resistance are the essentials of conservative treatment. Results are usually satisfactory and rapid except in the presence of overwhelming general infection, when the prognosis is bad and surgery is almost invariably fatal. When definite localization has occurred, incision and drainage with a minimum amount of trauma is indicated. Recurrence of symptoms and a severe general infection often follow too vigorous exploration of an abscess cavity with the destruction of the protective zone by mopping or distention with gauze. In infection of the lip or face, the same care and skill are essential,[160] reports of death within a week of the occurrence of an apparently trivial infection being all too frequent. Infections of the parotid gland and its space may occur as complications of operations upon the abdomen or genitourinary tract, usually in patients in whom the general condition is poor. A predisposing cause is thought to be dehydration or a dry mouth, and such local measures as mouth washes, chewing gum, or the use of lemon candy are suggested for prophylaxis. Treatment by hot or cold applications is optional as neither method seems to have an advantage over the other. The use of radium packs has been followed by good results in some cases. Conservative treatment should give results in three to four days, and, if it does not, incision is indicated without waiting for fluctuation because the infection lies under a deep layer of dense fascia which renders palpation difficult. Incision of this fascia is usually sufficient to relieve tension and permit the exit of infection which otherwise might invade the great blood vessels of the neck causing thrombosis or hemorrhage. Infections about the upper lip and nose rapidly become subcutaneous on account of the absence of fascial spaces, and the spread of infection is promoted by the constant or frequent motion due to muscular attachments to the skin. The venous system of the face is characterized by the absence of valves and by free anastomosis, and the normal direction of flow of venous blood toward the facial and internal jugular veins may be reversed by the pressure of exudate or edema spreading the infection through the angular vein to the cavernous sinus. Treatment of such an infection is usually unsatisfactory, and the result is often fatal. Staphylococcus infections are usually more serious than streptococcus and may result from minute lesions of the skin or mucous membrane. Redness and edema, spreading from the lips toward the inner canthus of the eye, are danger signals, and exophthalmos or paralysis of the ocular muscles indicates thrombosis of the cavernous sinus. Incision of boggy, edematous tissues without definite indications of localization is absolutely contraindicated and will invariably result in the spread of infection and lowering of local and general resistance, often with fatal termination. When thrombosis of the angular vein seems imminent, opinion is divided as to the necessity of ligation; both good and bad

results have followed this procedure. The best results follow a rigid, determined, and prolonged adherence to the utmost conservative treatment. General anesthesia should be used if definite indications warrant incision as local infiltration tends to spread the infection. In the treatment of acute infections, whether of the face or other part of the body, rest plays an important and essential part,[161] and this may often be satisfactorily secured by the use of adhesive plaster as well as splinting. The treatment of pyogenic processes by various types and methods of irradiation continues to be reported by many observers,[162, 163] blood or pus being withdrawn, subjected to ultraviolet radiation and reinjected. Roentgenotherapy used in the treatment of gas bacillus infection in conjunction with serum has given definitely better results than the use of serum alone. Definite indications for the use of radiant energy will no doubt develop following careful study and investigation and, it is to be hoped, will permit improved treatment of these conditions based on accurate knowledge.

TREATMENT

The value of moist heat applied to the abdomen is generally recognized. A clinical and experimental study[164] indicates that there is slight, although definite, penetration of heat in the abdomen of a child, but none in the adult, and that prolonged application of heat does not increase penetration. In experimental animals, the application of heat does not affect intestinal tone or movements.

Intraperitoneal Injections.—The difficulty of puncturing the bowel during intraperitoneal injections is well known. This complication, however, may occur. In experimental animals it was found[165] that simple penetration of the bowel wall did no damage, and the perforation healed quickly. The ordinary solutions of glucose and saline when injected into the bowel wall do no harm in small amounts, but produce necrosis if the amount is large. Solutions which are not isotonic or which are of unusual chemical composition may cause necrosis with perforating ulcer when injected into the bowel wall.

Blood Tests.—The use of the blood sedimentation test and of the Schilling count is not as general as would seem justified, since reports of controlled observations seem to indicate that they have a definite place in the regulation of treatment.[166] The two procedures show a parallelism in infection. The Schilling count indicates a clearing of infection and a gradual subsidence of a pathologic process more accurately than the sedimentation test, while the sedimentation test indicates physiologic changes and therefore reflects the patient's general condition better than the Schilling count. The sedimentation test, therefore, is of value in determining the completeness of convalescence. The use of both tests gives better information and a better guide to treatment than the use of either one alone.

Staphylococcus Toxoid.—Reports of the treatment of staphylococcic infections by the recently developed staphylococcus toxoid continue to be encouraging.[167] Careful clinical observations indicate that it is useful in furunculosis, carbuncles, sties, acne, and chronic or subacute osteomyelitis. As might be expected, the results in acne are not as good as they are in pure staphylococcus infections. In cases of convalescence

from acute staphylococcus infection and from toxemias due to this organism, the injections seem to be advantageous. It has been shown that the blood titer of antitoxin can be increased ten times, but usually a slight increase is sufficient to produce results. The estimation of circulating antitoxin is not usually necessary but is of considerable value in obscure bone infections. As a result of injections of the toxoid, the amount of circulating antitoxin rises to a certain point and then is not increased by additional doses. In a small percentage of cases acute exacerbations follow the first two injections, but general and local reactions are surprisingly few. The initial dose should be small enough to produce only a slight reaction, and the interval between doses is from two to seven days. Six to ten doses are usually sufficient. Subcutaneous injections are more painful than intramuscular ones. The treatment is rational and scientifically accurate, and good results will no doubt continue to be reported.

Wound Stimulation.—Study of the excretions of maggots used in the surgical treatment of sluggish granulations has led to the discovery of a substance, the chemical composition of which is identical with that of allantoin.[168] This substance may be obtained from vegetable sources and is available commercially in a pure, inexpensive form. Reports of its use for purposes of stimulating slow healing wounds date back many years. It is nonirritating, and it may be applied daily in wet dressings or poured into the wound. It is apparently indicated in such conditions as chronic ulcers, failure to heal after extensive burns, sluggish granulation tissue, and open wounds with poor circulation or purulent discharge, the use being followed by healthy granulations after the first few treatments. The rate of healing, however, is not always as rapid as when maggots are used, and hence it will probably not entirely replace that method. Since with many individuals there is a certain psychologic as well as physical objection to the use of maggots, allantoin may well be of value in such cases.

Bacteriophage.—Reports of the use of bacteriophage therapy are distinctly fewer in number than several years ago, but show, in general, more careful study and evaluation of results. The character and mode of action of this substance are still open to doubt, but good results following its use are still frequently reported. Its activity may be due to an enzyme or to the specific action of bacterial protein or to the nonspecific effect of broth proteins. There seems to be little evidence that it actually kills bacteria in the body except possibly in the bladder and in walled-off cavities where large amounts can be used. Its greatest value seems to be in local staphylococcic infections and in cystitis. It has been used with good effect in the treatment of carbuncles,[169] being considered preferable in early cases to incision and drainage, and has also been of benefit in infections of the upper lip, being used, however, in conjunction with other usual treatment. Injections should be made subcutaneously at the junction of the normal and indurated tissues. In cases of staphylococcic septicemia results from this treatment are not so good as those following the use of staphylococcus toxoid. In the treatment of peritonitis[170] commercial polyvalent bacteriophage seems better than the colon bacillus type: the difference between cases treated by bacteriophage and those treated without, however, is negligible. In the treatment of lung abscesses and purulent bronchitis,[171] the use of a specially prepared, polyvalent, staphylococcus bacteriophage resulted

in steady improvement and change of secretions from thick to thin. Eighteen cases were treated with only one poor result. The abscesses were evacuated, and the thick mucus removed by means of a bronchoscope followed by introduction of the bacteriophage, treatment being given every seven days. The possible good effect of repeated bronchoscopic drainage and removal of mucus may have been a factor in the improvement, although the intervals between treatments were too long to ascribe the good results entirely to this.

Rectal Glucose.—In the controversy regarding the absorption of glucose by bowel following rectal injection, there seems to be a general unanimity of opinion that the use of hypertonic solution should be avoided on account of the resultant withdrawal of water from the tissues.[172, 173] It also seems to be reasonably well established that a certain amount of glucose is absorbed but that the rate of absorption is not as great as that in the small bowel and that the amount absorbed is inadequate for ordinary clinical requirements. The fact that more glucose is absorbed when larger amounts of the solution are used may possibly be explained by the fact that the rate of absorption is higher in the ascending colon than in the descending colon and sigmoid and also by the fact that some of the solution may pass through the ileocecal valve and be absorbed by the terminal ileum.

Blood Transfusion.—The choice of any one of several methods for determining the compatability of blood for transfusions would seem to depend upon the individual preference of the operator. Reactions occur following the selection of donors by any of the accepted methods, but with the development of more exact technic and better apparatus they are becoming reduced to a reasonable minimum. With the Moss method of grouping used in one series of over 15,000, the occurrence of reactions has been found not to exceed those which occur after selection by direct matching.[174] During the past year all transfusions were by the indirect citrate method. In addition to its use in shock and hemorrhage, transfusion is especially valuable in sepsis,[175] a series of seventy-five cases showing approximately 80 per cent excellent results. Unmodified blood was used by the Kimpton-Brown tube technic, and the conditions treated included sinus thrombosis, meningitis, streptococcic empyema, septic arthritis, osteomyelitis, and septicemia. Large amounts of blood were used, and transfusions repeated as often as indicated. In a sixteen-month-old infant 300 c.c. were given at one time, and in a six-year-old child four transfusions of 500 c.c. each were given during a period of one month. Careful tests for syphilis should be made in all cases except the gravest emergencies,[176] as the transmission of syphilis by blood transfusion has occurred too frequently to justify taking chances. One of the greatest factors in the smooth performance of a transfusion is accurate technic and good teamwork.[177] Great care should be taken in the cleaning of all apparatus and old or defective rubber tubing should never be used. The production of unnecessary pain should be avoided, and pain is usually unnecessary, as sufficient local anesthetic may be used without in any way interfering with the introduction of the intravenous needle. "Anesthesia is not a courtesy; it is a right."

Intravenous Therapy.—The intravenous introduction of various solutions is often a lifesaving measure. The rate of introduction, the solution, the amount, and the method are all subject to individual variation. Reactions which have occurred have been variously ascribed to

too great speed of introduction, to impurities in the solution, and to defects in the apparatus. It would seem that in some instances idiosyncrasy on the part of the patient may be responsible for an untoward reaction, and in others it is possibly due to the pathologic condition which is being treated. The continuous administration of solutions by the intravenous route is widely used, and an analysis of 1,000 cases[178] gives an excellent idea as to its value. The usual rate was from 2 to 3 c.c. per minute, totaling from 2,500 c.c. to 4,000 c.c. per day, and the period over which administration was continued varied from a few hours to twenty-four days. The solutions commonly used were normal saline or glucose, and others could be injected at the same time by means of a needle passed through the wall of the rubber tubing. Such substances included epinephrine, pitressin, insulin, whole or citrated blood, serum, and many others. Serum reactions were minimized by slow introduction even when amounts of 200,000 or 300,000 units were given in one day. The serums used included pneumococcic, diphtheritic, and antitetanic. No circulatory complications were reported. By constant close supervision local pain and discomfort were avoided, also no local inflammation appeared in the skin or vein. When properly regulated, the introduction of large amounts of fluid caused no increase in the blood pressure or in the tendency to bleed. Edema of the lungs or peripheral edema usually indicates excessive accumulation of sodium chloride and may be reduced by using distilled water or 5 per cent to 50 per cent dextrose instead of normal saline. If the edema is severe, the administration of fluids is temporarily discontinued and dehydration treatment instituted. The term "intravenous drip" should give place to "continuous intravenous injection." The word "drip" implies the drop method which suggests the possibility of the introduction of air, and, while experimental air has been introduced intravenously in animals without appreciable effect, it might not be equally harmless in a seriously ill patient. A bulb in the intravenous apparatus facilitates the counting of drops, and it is easily seen how air from this bulb might enter the vein. This complication can be prevented by using a long container or buret of about 500 c.c. capacity which will permit sufficiently accurate estimation of the rate of flow. With this type of container the bulb is unnecessary.[179] The continuous intravenous injection of saline or glucose solutions has been considered a cause of pulmonary embolism in experimental animals, but the comparison of patients with experimental animals in this regard seems questionable. It seems reasonable to assume that with the widespread use of continuous intravenous administration of fluid, pulmonary embolism would have been reported if its occurrence could have been ascribed in any way to the treatment. Reaction has at times been attributed to the rapidity of introduction of the solution—the so-called speed shock.[180] Large quantities of fluid and blood have been given rapidly, however, without the production of serious symptoms, and in most instances a reaction was either absent or minimal. In one instance 500 c.c. of blood were given within three minutes, and in many others the rate of injection varied from 38 c.c. to 177 c.c. per minute. These observations were upon adults and would possibly not apply to the same degree in children but are cited as indications that large quantities of fluid and blood may be given safely in a relatively short time. In a study of the administration of glucose,[181] it has been shown that one effect is the dehydration of the protein of

the blood which has been hydrated by shock or other conditions, and, if this dehydration is carried too far, it will produce thrombosis. Such dehydration may be combated by the use of insulin or subcutaneous oxygen. It does not occur, however, with the usual rate of administration, 40 drops per minute of a 5 per cent glucose solution being well within the limits of safety. It was also found that in pneumonia the oxygen-carrying power of the blood is increased by the administration of 25 c.c. of 50 per cent glucose solution twice daily over a period of two to five days. Untoward reactions consisting of prolonged chill and high fever were considered to be due to impurities in the glucose or the rubber tubing. Among the conditions benefited by intravenous glucose are cyclic vomiting of childhood, malnutrition, diphtheria, severe burns, sepsis, and postoperative shock. The value of the intravenous administration of fluid either in small amounts or by continuous introduction is so great that the untoward reactions, which occasionally occur, should not prevent or minimize its use.

Water Balance.—The absorption and excretion of water and substances in solution is a constant and continuous process.[182] Disturbances of water balance may produce extremely serious consequences and attention to its maintenance may make the difference between smooth convalescence and postoperative morbidity or even mortality. For the normal adult the average fluid intake is from 2,000 c.c. to 3,400 c.c. a day, and excretion should be approximately the same. Of this the insensible loss by way of the skin and lungs varies from 1,000 to 1,500 gm. daily. The period of operation and recovery is a period of dehydration, an average loss being about 1,000 c.c., in which connection postoperative perspiration is seriously to be considered, as the fluid loss may reach 2,000 c.c. per day. In the presence of fever, the insensible loss of fluid is less. In the average adult surgical patient, the daily intake should be between 3,000 c.c. and 4,000 c.c. with slightly less for children. In abnormal conditions, however, this may not be sufficient to prevent dehydration. The specific gravity of the urine is a good index of dehydration and the amount passed indicates the adequacy of the supply, as the kidney excretes only the water which is available after other excretion has occurred. This, of course, presupposes a normally functioning kidney and a specific gravity of 1.015, and a urinary volume of not less than 1,500 c.c. is advisable. Salt is the chief electrolyte lost in the excretion of fluid, and, if the loss is too great, the symptoms may be a sense of fatigue, exhaustion, nausea, vomiting, abdominal cramps, or muscular twitching. An excess of salt produces edema. This may occur rather rapidly if there has been an excessive removal of water from the body, resulting in a concentration of salt. The carbohydrate threshold during the intravenous administration of 5 per cent glucose is very high, particularly in the presence of infection, 50 gm. of glucose per hour being required in a 120-pound individual to produce glycosuria. The most desirable method of administering both salt and glucose solutions is to alternate a liter of 5 per cent glucose with a liter of normal saline. The temperature of the solution is of little importance, and overloading of the cardiovascular system has not been noted in adults, even with the administration of 200 c.c. to 500 c.c. per hour. The only symptoms noted upon the administration of excessive amounts is slight discomfort and a tendency to prevention of sleep. By careful attention

to the symptoms, to the excretion of urine and to blood chemistry, the amount of fluid which is actually needed can be fairly accurately estimated.

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American Academy of Pediatrics

Proceedings

FIFTH ANNUAL MEETING OF THE AMERICAN ACADEMY OF PEDIATRICS

WALDORF-ASTORIA HOTEL
NEW YORK CITY, JUNE 7, 1935

Round Table Discussion on Bacillary Dysentery

The meeting was called to order by Dr. Wilburt C. Davison, of Duke University School of Medicine, Durham, N. C.

CHAIRMAN DAVISON.—All subjects in pediatrics are divided, like ancient Gaul, into three parts: diagnosis, treatment, and prevention. In dysentery, diagnosis is fairly easy. A physician is called because a child has an increased number of stools; a diagnosis of diarrhea is obvious, and the type of diarrhea can be determined from the history. The methods of treatment and prevention will be discussed later.

Diarrhea is known under a number of names: summer diarrhea, cholera infantum, colitis, infectious diarrhea, fermentative diarrhea, gastrointestinal indigestion, etc. In 1904, as the result of the work of two third-year medical students, C. W. Duval and V. H. Bassett, and of Dr. Simon Flexner and the Rockefeller Commission, it was possible to divide diarrhea into two different groups. These students cultured the stools of a large number of children suffering from diarrhea. From a certain number they isolated the bacillus of dysentery, thus definitely establishing a group of known etiology or bacillary dysentery and separating it from another group of unknown etiology which consists of all the other types of frequent stools in infants.

The onset of bacillary dysentery is sudden in 80 per cent of the cases. An example of the history which usually is obtained from a patient's mother is as follows:

"At 6 o'clock Monday, when she gave the baby his bottle, nothing was wrong. At 10 o'clock the infant refused to take his feeding, and he apparently had fever. She persisted in trying to feed him, but after two or three mouthfuls he vomited. Four or five hours later the mother noticed that instead of his usual one stool a day the child had two or three stools during the afternoon. The loss of appetite persisted, and the number of stools rapidly increased so that by the end of the third day the child was having from ten to thirty stools daily."

The stools in bacillary dysentery are very characteristic: They are small, about a tablespoonful usually, accompanied by marked tenesmus and pain, and after the second day they contain blood and pus. In some cases there are convulsions at the onset; in others the infant may be either very irritable or very drowsy. The physical examination is of very little assistance. Signs of dehydration are present as one would expect from the loss of water from the bowel. The average white count is 13,000, but this slight increase may well be due to the dehydration rather than a true leucocytosis; children who have dysentery without dehydration may have leucopenia, as in typhoid fever.

Among hospital patients, about 20 per cent die in the first twelve days, but in private practice the mortality is lower. Seventy per cent have a normal temperature by the sixth day, and their stools become normal about the fourteenth day. About 5 per cent die during convalescence as a result of pneumonia and other complications. Convalescence usually is prolonged because the loss of appetite, which characterizes it, persists six or seven weeks. Feeding some of these children is often difficult; loose stools and dehydration may persist, and the weight gain may be very slow.

About 80 per cent of the cases of diarrhea in infants in which the onset is sudden usually can be proved bacteriologically to be bacillary dysentery. If cultures of the stools of the patients are made within two hours after they have been passed, *B. dysenteriae* (Flexner) can be isolated in about 70 per cent, the Shiga bacillus in 10 per cent, and typhoid or paratyphoid bacilli in another 10 per cent. This percentage varies in different years. Clinically these cases rarely can be differentiated from each other. If the stools are several hours old, the percentage of positive stool cultures is much lower. In addition to the stool cultures, these cases can be proved to be bacillary dysentery by agglutination reactions. These reactions usually are worthless, however, unless the five different strains of the Flexner bacillus and the one Shiga strain are used as antigens.

The pathologic changes in the intestines of the children who die vary from hyperemia and slight inflammation of the mucous lining to the formation of a definite pseudomembrane. The length of the illness is not an important factor in determining the type of lesion except that in the patients who die during convalescence ulceration of the intestines is more common. The central nervous system changes described in the Shiga type of infection are extremely rare in children.

Unlike the diarrhea of known etiology, or bacillary dysentery, the diarrhea of unknown etiology is not a clinical entity. Possibly in the future this motley group may be subdivided into several varieties, but at present there is no satisfactory basis for differentiation. "Fermentative diarrhea" is the term most commonly applied to these cases, but I shall use the term "ordinary diarrhea" to distinguish them from bacillary dysentery. The usual history is that during hot weather, after improper feeding, or following some febrile, parenteral infection, such as otitis media or mastoid disease, the number of stools gradually has become increased. This gradual onset is in marked contrast to the usual sudden onset of bacillary dysentery. The stools are large in amount, watery and loose. They contain no blood or pus, but mucus, which frequently is difficult to distinguish from pus, often is present. Pain and tenesmus usually are absent. These children usually have no fever except from dehydration or a parenteral infection. Sydenham, who used the term "looseness" for ordinary diarrhea, wrote in 1669 the following differential description of bacillary dysentery and ordinary diarrhea, which has not been improved upon, though practically forgotten: "Dysentery differs from a looseness by being attended with more violent gripings, and the discharge of bloody, purulent, putrid, and extremely fetid matters; whereas what is voided in a looseness is either serous, slimy, or bilious, but never bloody."

There are numerous theories which have been advanced to explain the causation of ordinary diarrhea. Various bacteria, such as *B. welchii*, *B. coli*, Morgan's bacillus, and a putrefactive or fermentative flora, have been held to be responsible for ordinary diarrhea, but bacteriologists who have examined the stools of normal children have found these same organisms just as frequently as in the stools of children who were suffering from diarrhea. Furthermore, the children who die of ordinary diarrhea have no evidence of intestinal inflammation, such as would be expected if the condition were caused by bacterial infection as, for example, in bacillary dysentery and typhoid fever. According to another theory, ordinary

diarrhea is due to the absence of *B. acidophilus*. However, this organism is as frequently absent from the stools of normal infants as it is from those of diarrheal patients. The following theory, namely, that of duodenal infection, is at least plausible.

More demonstrated that children who die with ordinary diarrhea have duodenal contents which are heavily infected with *B. coli*, whereas the duodenal contents of children who die with other conditions are practically sterile. Whether this duodenal infection is the cause or the result of diarrhea has not as yet been definitely proved, but, if the end products of the growth of *B. coli* are fed to dogs through a duodenal tube, diarrhea can be produced. It is sometimes assumed that this duodenal infection is due to organisms entering through the mouth, but in the diets fed to infants, usually boiled milk or buttermilk, it is almost impossible for large numbers of *B. coli* to reach the duodenum by way of the mouth or stomach. It is more likely that they ascend from the cecum and large intestine. This migration of bacteria into the duodenum might possibly be explained on the basis of some primary physiologic disturbance which causes an accumulation of undigested food in the upper intestine and there provides a medium for the growth of these organisms. As a matter of fact, at autopsy the duodenum of an infant who has died of diarrhea contains a large amount of undigested food, whereas that of a patient who has succumbed to some other condition is practically empty.

In order to learn whether there was any primary physiologic disturbance which could explain this accumulation of undigested food and the presence of *B. coli* in the duodenum, the duodenal contents were collected from a number of children suffering with various conditions. In the duodenal contents of normal children there was a large amount of enzymes (trypsin and amylase); in those of infants who had ordinary diarrhea, there were practically no enzymes, while in those of patients who had dysentery the enzyme content was almost normal. From an examination of the duodenal contents before and after fever, it was learned that almost any febrile disease could decrease the enzyme secretion. From these studies it was concluded that diarrhea of unknown origin, or ordinary diarrhea, probably depended upon several factors: first, a primary condition such as fever, infection, overfeeding, or external heat (hot weather) causes a decreased duodenal enzyme secretion; second, undigested and unabsorbed food then accumulates in the duodenum; third, organisms from the cecum and large intestine invade the duodenum and ferment this food material, and finally the irritating end products of bacterial growth accelerate peristalsis and produce diarrhea. In other words, ordinary diarrhea may be due to the accumulation of food and the growth of bacteria in the duodenum instead of in the normal location in the large intestine. A very good statement of this theory was made by James Jackson in 1812. He attributed "the chemical changes which take place in the contents of the stomach and bowels of children dying of diarrhea to the putrefaction of animal food and the acetous fermentation of that which is vegetable."

Treatment.—(a) *Fluid* and electrolyte administration is the most important feature of treatment. Infants, who as a result of diarrhea or vomiting are markedly dehydrated, have lost considerable weight and are in a critical condition, should be offered water, with saccharin if necessary, by mouth every hour unless contraindicated by nausea, and they should receive 0.9 per cent saline or Ringer's solution intraperitoneally, or 10 per cent dextrose, or Hartmann's combined solution intravenously or subcutaneously (if the CO_2 combining power of the blood is low), or all these procedures, depending on the severity of the symptoms, and they should be transfused *after* fluid therapy. If the blood chlorides are reduced, the intravenous injection of 20 c.c. of 10 per cent sodium chloride may be efficacious; and, if the plasma proteins are low, the intravenous use of 30 per cent acacia may be beneficial.

The injection of calcium gluconate before fluid therapy has been recommended. (b) *Feeding:* If an artificially fed infant has diarrhea but no vomiting, whether due to dysentery or to acute intestinal indigestion (ordinary diarrhea), he usually should be given whole lactic acid milk, at first in amounts of 30 to 60 c.c. (1 to 2 oz.) at each feeding, and later in increasing amounts in accordance with the infant's appetite because its bactericidal action will reduce the growth of bacteria in the upper intestine which accompanies diarrhea. Generally from the first day, 2.5 per cent cane sugar is added to the whole lactic acid milk, i.e., 2.5 gm. (½ teaspoonful) per 100 c.c. or per 3 oz. of milk. When the stools are "formed," usually within four days, the amount of cane sugar may be increased to 5 per cent (5 gm. per 100 c.c., or ½ teaspoonful per 2 oz. of milk), and three or four days later, to 7.5 per cent (7.5 gm. per 100 c.c., or ½ teaspoonful per ounce of milk). As molasses may cause distention and loose stools, it should not be substituted for cane sugar until later. The amounts of the feedings then should be increased so that the infant will receive 100 calories per kilogram of body weight, i.e., 100 c.c. of whole lactic acid milk containing 7.5 per cent of sugar per kilogram of body weight (or 1½ oz. per pound). However, if the stools are very loose, 7.5 per cent of casec (calcium caseinated) instead of cane sugar should be added to the whole lactic acid milk from the onset, i.e., 7.5 gm. per 100 c.c., or 1 tablespoonful per ounce of milk. If casec is used, the nipple hole should be enlarged, and the bottle shaken frequently during the feeding because of the large particles of casec. To infants over five months of age with diarrhea, but no vomiting, whose appetites are good, 30 to 60 gm. (1 to 2 oz.) of junket (without whey) may be fed by spoon at one or two feedings daily after they have drunk their whole lactic acid milk. If a breast-fed infant develops diarrhea, or is infected with dysentery, the breast feedings at four-hour intervals should be continued. If the number of stools is excessive, 30 to 120 c.c. (1 to 4 oz.) of whole lactic acid milk with or without cane sugar or casec may be substituted for breast feeding for a few days. The mother should keep up her milk supply by breast massage or breast pump. If an infant *vomits,* he should receive nothing except water by mouth for twelve to twenty-four hours; saline should be given subcutaneously. He then may be given whole lactic acid milk, with or without cane sugar or casec as outlined above. A diet consisting of 2 to 4 tablespoonfuls of scraped, ripe apple pulp, every two to four hours (up to 20 apples daily) has been recommended. Infants who persistently refuse food, and premature infants, may be fed by gavage by a Chetwood syringe, by a Boston feeder, or by a medicine dropper. If infants refuse water, 30 to 60 c.c. (1 to 2 oz.) of water may be added to these gavage feedings. (c) *Drug Treatment:* Infants who are restless and in pain as a result of dysentery or diarrhea may be given 0.3 to 0.6 c.c. (5 to 10 minims) paregoric after every stool (to a daily maximum of 4 to 8 c.c.—1 to 2 drams—depending upon the age and size of the patient) in order to relieve the straining and tenesmus and to insure a certain amount of sleep. For ordinary diarrhea and dysentery, no other drugs have been found efficacious although innumerable ones have been recommended. Castor oil, calomel, salts, and other purgatives actually are harmful. The addition of charcoal and chalk to milk is of no benefit. Emetine, yatrin, an carbasone should be used in amebiasis. (d) *Serum Treatment:* Antidysenteric serum (both Flexner and Shiga types) and Shiga antitoxin have no apparent value for children. Bacteriophage or bacteriolysant therapy also is without benefit. (e) *Environment:* Infants with diarrhea recover much more quickly if kept in a cool room. Placing a tub with a large cake of ice near the bed, and having an electric fan blow across the ice on the patient is beneficial; the risk of pneumonia is not increased. In children suffering from ordinary diarrhea, sources of infection should be sought and treated.

The *prevention* of ordinary diarrhea and dysentery is of extreme importance. The number of cases is decreasing each year, probably the result of the wider dis-

semination of knowledge of infant feeding and the decrease in the number of flies. During the war it was demonstrated that bacillary dysentery in troops was often spread by flies. A fly can cover eight miles in a day and is an important factor in carrying dysentery bacilli from infected stools. Dysentery in adults usually is a very mild disease, and, as it frequently is not recognized, these cases are a menace to the infants in a household. The subcutaneous injection of dysentery vaccines will prevent the spread of dysentery, but the reactions produced are rather painful. It is conceivable that immunity to dysentery can be produced by giving vaccines by mouth, but the results so far have not been hopeful.

The following measures may prevent the spread of dysentery: (1) the feeding of whole lactic acid evaporated milk mixtures to infants under two years of age; (2) the boiling in their final containers of all sweet milk mixtures that are fed to infants under two years of age; (3) the thorough washing of the mother's or attendant's hands with soap and water every time she has been in contact with excreta of an individual suffering from diarrhea of any form, or before she handles food for children; (4) the keeping of the excreta and soiled clothing of patients suffering from diarrhea in covered buckets containing soap powder and water until they can be boiled; (5) the screening of houses, and the use of mosquito nets for the beds of children to prevent the access of flies.

In spite of the decrease in the number of cases of dysentery and ordinary diarrhea, they are still more common than usually is believed. In Baltimore during the summer of 1925, Lawson Wilkins kept careful records of 628 infants. Sixty per cent remained well; 27 per cent developed ordinary diarrhea, and 13 per cent developed bacillary dysentery. The large amounts of money spent in the prevention of diphtheria, smallpox, typhoid fever, and scarlet fever are in marked contrast to the lack of money and effort devoted to the control of bacillary dysentery; yet in most cities bacillary dysentery kills more children than all the infectious diseases put together. This disease should be recognized more often and steps should be taken to reduce its incidence (from South. M. J. 31: 349, 1928).

DR. GEORGE M. LYON (HUNTINGTON, W. VA.).—May I ask if you know of any dysentery bacillus being recovered from milk?

CHAIRMAN DAVISON.—Not from a central dairy, although hospital and orphanage dysentery epidemics have been due to the infection of the milk after it has been delivered to the institution.

DR. LYON.—I have felt the flies to be a more important vector than either milk or water. It is often said one cannot recover Flexner organisms from the feet of flies, but it can be done. We have done it. Similarly successful attempts have, however, not been described in the available literature.

CHAIRMAN DAVISON.—During the war dysentery bacilli were recovered from the feet, intestinal tracts, and wings of flies. The smaller number of flies during the past ten years, because of fewer horses, probably is the most important factor in the reduction of dysentery. The boiling of milk and containers, and more especially the use of lactic acid milk, also have decreased the chance of infection from flies. Lactic acid milk, or buttermilk, was first advocated as a means of treating diarrhea and keeping babies healthy by von Rosenstein in his *Diseases of Children*, which, in 1776, was translated into English. However. it was not widely used until Dr. Marriott popularized it in 1918. During the last few years, as a result of further work by Dr. Marriott, large numbers of infants have been fed with whole lactic acid evaporated milk.

Whole lactic acid milk, at present, probably one of the best artificial infant foods, is of three varieties: (1) whole lactic acid *evaporated* milk, (2) whole lactic acid

cultured milk, and (3) whole lactic acid *chemical* milk. All three are satisfactory, but the first is the cheapest, the second the easiest to use (if it can be purchased from a dairy), and the third a good substitute, if either of the others is not available. Whole lactic acid evaporated milk containing 7.5 per cent of added carbohydrate is made by diluting unsweetened evaporated whole milk (White House, Pet, Borden's, Carnation, etc.) with an equal amount of cooled, boiled water, to which previously have been added 1.5 per cent of lactic acid (U.S.P.)—1.5 c.c. (39 drops) lactic acid per 100 c.c., or 12 drops per ounce of boiling water—and 15 per cent of cane sugar or molasses—15 gm. (3 level teaspoonfuls) per 100 c.c., or 1 level teaspoonful per ounce of boiling water. Whole lactic acid milk should never be repasteurized or boiled as it will curdle. The quantity required for each feeding can be made separately, but preferably the total amount needed for twenty-four hours should be made at one time, divided into feedings in clean, sterile, nursing bottles, plugged with sterile nonabsorbent cotton, and kept in a refrigerator. Mothers usually are instructed to warm the bottle containing the feeding to body temperature (37° C. or 98.7° F.) by placing it in a tall cup or pitcher of warm water before giving it to the infant. However, there is no harm in giving the bottles at room temperatures, or even colder. Bottles should not be kept warm for long periods and should be shaken before using. Cane sugar is a satisfactory carbohydrate, but molasses has the advantage of containing 0.0073 per cent iron and 0.27 per cent calcium. One tablespoonful of molasses contains more iron (1.64 mg.) than one egg (1.35 mg.). However, molasses sometimes may cause distention, loose stools, or vomiting, especially in premature and weak infants. To have the same caloric content, the number of grams of molasses used should be one-third more than that of cane sugar because 100 gm. of cane sugar contain 400 calories, and 100 gm. of molasses furnish 287 calories. However, the number of level tablespoonfuls of molasses should be the same as that of cane sugar because two-thirds of a tablespoonful of molasses has the same weight as one tablespoonful of cane sugar. In other words, the caloric content of mixtures containing molasses or cane sugar will be approximately the same if both are measured by volume in level tablespoonfuls. Brer Rabbit (green label) is a satisfactory brand of molasses. As some infants may have a transitory diarrhea when starting on a diet containing molasses, only 5 per cent should be added during the first week and 7.5 per cent thereafter. The reason for adding 7.5 per cent carbohydrate to whole lactic acid milk is that infants usually are constipated if the amount is less and their stools generally are "loose" if it is more. Furthermore, the caloric calculations are greatly simplified by the addition of exactly 7.5 per cent sugar, for the resulting mixture then contains one calorie per cubic centimeter. The addition of carbohydrate to lactic acid milk is unnecessary for infants after the age of eight months.

The home instructions are simple and are especially useful for infants who are to be taken on a journey: The contents of a large can of unsweetened evaporated milk (390 c.c., or 13 oz.) are poured into a quart bottle, previously "scalded" with boiling water, and the empty can nearly filled with boiling water, in which then are dissolved 1 teaspoonful of lactic acid (U.S.P.) and 3 level tablespoonfuls of cane sugar (or molasses). As soon as this solution is cold, it is poured slowly into the quart milk bottle containing the unsweetened evaporated milk, while the bottle is shaken constantly. In order for the lactic acid to accomplish its bactericidal effect, the mixture should be kept for six hours, preferably, though not necessarily, in a cold place before being fed in required amounts to the infant. After being mixed, it should not be repasteurized as it will curdle. This mixture (810 c.c., 27 oz.) is sufficient for a twenty-four-hour diet for any infant, regardless of age. Older children, of course, require solid food in addition.

Whole lactic acid *cultured* milk is pasteurized grade A or B milk, which has been inoculated with a culture of *B. bulgaricus* or *B. acidophilus* and *Streptococcus acidi lactici* at the dairy or in the home (these cultures, or milk starter, may be obtained twice weekly with directions for use from the Vitalait Laboratories, Inc., Augusta, Me.), and heated to body temperature (37° C. or 98.7° F.) for fifteen minutes and placed in a fireless cooker overnight. Thirty cubic centimeters (1 oz.) of this buttermilk should be kept in a cool place as a starter for the next day's supply. Then 7.5 per cent carbohydrate (7.5 gm. or 1½ level teaspoonfuls per 100 c.c., or ½ teaspoonful per ounce of milk) is either dissolved directly in the milk or first dissolved in 15 c.c. (1 tablespoonful) of boiling water and this solution added to the milk. Whole lactic acid cultured milk should never be repasteurized, or boiled, as it will curdle. The total amount needed for twenty-four hours should be purchased, or made, at one time, the carbohydrate added, and the mixture kept in a refrigerator until part of it is required for a feeding. Whole lactic acid *chemical* milk is made by adding drop by drop 2 teaspoonfuls of lactic acid (U.S.P.) or 2 tablespoonfuls of lemon juice to one quart of cold pasteurized grade A or B milk while it is being stirred.

The only theoretical objections to the use of whole lactic acid evaporated milk are that the vitamins are destroyed and that the taste is altered. However, all children between the ages of two weeks and three years, regardless of their type of feeding, should receive daily from 2 to 4 tablespoonfuls of tomato (or orange) juice to prevent scurvy, and from 3 to 4 teaspoonfuls of cod liver oil to prevent rickets. Some infants dislike whole lactic acid evaporated milk, especially those who previously have been fed with very sweet mixtures; but, if the physician and mother cooperate, this difficulty can always be overcome. In fact, many of these children, after they have become accustomed to whole lactic acid evaporated milk, refuse to drink sweet milk—a consummation much to be desired. The addition of flavoring extracts, such as chocolate syrup, will improve the taste of evaporated milk, especially for older children and adults.

There are, of course, innumerable other feeding mixtures and formulas which have been recommended for infants. Infant foods should be judged by at least five criteria, all of which whole lactic acid milk (evaporated, cultured, or chemical) satisfies:

1. *Digestibility:* Infants thrive on whole lactic acid milk, at least as well as they do on breast milk. The incidence of diarrhea, vomiting, and bacillary dysentery is lower in infants fed lactic acid milk mixtures than in those receiving any other artificial food.

2. *Safety of Source:* The evaporation process of the whole lactic acid evaporated milk and the initial pasteurization of the cultured and chemical varieties remove the risk of Brucella infection (undulant or Malta fever), diphtheria, foot and mouth disease, scarlet fever, septic or streptococcus sore throat, tuberculosis, typhoid, and paratyphoid A and B fevers, and other diseases which can be spread from a dairy.

3. *Safety in Home Handling and in the Infant's Intestines:* The determination by Rothey that dysentery, typhoid, and paratyphoid bacilli when added in large amounts to all three types of whole lactic acid milk are destroyed rapidly is a demonstration of bactericidal power which no other infant feeding possesses. The antibacterial or lysozyme strength of breast milk is weak in comparison. Sweet milk mixtures even when boiled in the nursing bottle can be infected by the mother's hands while attaching the nipple; lactic acid milk, because of its bactericidal activity, cannot readily be infected. This bactericidal action also is useful in reducing the growth of bacteria in the upper intestines which accompanies diarrhea.

4. *Economy:* Whole lactic acid milk, especially the evaporated variety, is cheaper than practically all other feedings, except breast milk, if it is assumed that breast

milk does not cost anything, a premise with which no mother would agree. The cost of whole lactic acid evaporated milk is half that of any other artificial feeding.

5. *Universal Obtainability:* Whole lactic acid cultured or chemical milk usually can be purchased or made anywhere, and the evaporated variety is obtainable everywhere. As a matter of fact, *what* is fed infants probably is less important than *how* it is fed, i.e., the amount and rate of feeding, interval between feedings, and last but not least the cleanliness, sterility, or bactericidal activity of the food, are more essential than the formula.

DR. EDWARD CLAY MITCHELL (MEMPHIS, TENN.).—The severity of dysentery varies in different years. We obtain cultures for as long as twenty-four hours by applying a swab to an ulcerated place in the rectum and placing it in a stoppered test tube. I had tried for a number of years all the various treatments of dysentery and the various serums but obtained no beneficial results. Blood transfusions are efficacious if dehydration is present. Dr. Ivy, Professor of Physiology at Northwestern University, found that dogs given lethal doses of Shiga toxin and also sodium thiocyanate at the same time did not die. He also fed sodium thiocyanate to dogs and found them protected against lethal doses of Shiga toxin given a week later. I asked Dr. Ivy what he thought of trying sodium thiocyanate during our next dysentery epidemic. He suggested an intravenous dosage of 20 mg. per kilogram body weight or a mouth dosage of 60 mg. (one-third grain) per kilogram of body weight, with a limit of one gram to any individual. We tried it for the two following summers, but all of the patients to whom it was given had been ill for at least thirty-six to forty-eight hours and did not appear to be benefited from it. However, the summer before last, a dysentery epidemic occurred at a levee camp, just across the river in Osceola, Ark. There was no sanitation, just the outdoor toilets, and no screening; many of the levee men had their families and children with them. During this epidemic, as many as three to five cases developed in a family. There were deaths not only among children but also in adults. This epidemic resembled what we have heard described as cholera. The patients became dehydrated rapidly, had as many as twenty to thirty bloody stools a day, and had toxic symptoms. We cultured the stools of thirty of these patients and found Shiga bacilli in all. In that epidemic we treated twenty-six patients with sodium thiocyanate and had only one death. We had thirty cases altogether of this severe toxic variety with six deaths, but five of these patients had not received any treatment. We also fed sodium thiocyanate to about two hundred individuals as a preventive, and few, if any, had dysentery, provided that the symptoms had not commenced before the sodium thiocyanate was started. The rule that we followed was that, as soon a a child developed any sign of nausea or slight diarrhea, we gave an injection of sodium thiocyanate. We found that, if it were given within twelve hours of the onset of symptoms, the patient always was benefited; if given between twelve and thirty hours, the child occasionally was benefited; but after thirty hours, no improvement could be noted. The preparation used was made by Abbott & Co. in 0.5 gm. ampules. (From J. PEDIAT. 6: 57, 1935.)

CHAIRMAN DAVISON.—Sodium thiocyanate certainly sounds promising and should be used in severe epidemics. In the ordinary epidemic, the Flexner variety cannot be distinguished from the Shiga on the basis of the severity of symptoms. However, there were two very severe epidemics in Virginia, and both were due to Shiga bacilli.

DR. MITCHELL.—We had one in Mississippi three years ago in which the mortality was 20 per cent.

DR. BENJAMIN BASHINSKI (MACON, GA.).—You say the maximum dose should be a gram in any one case?

DR. MITCHELL.—If there was no improvement after twelve hours, we repeated it. We repeated it as many as three times in some instances. In any one dose the largest amount we gave was 1 gm. There are some instances in the literature of symptoms after doses of more than 1 gm. in twenty-four hours.

CHAIRMAN DAVISON.—Dr. Lyon has some very interesting results to report. He made a survey around Huntington, W. Va.

DR. LYON.—The thing that has impressed me is that textbooks rarely picture dysentery the way we see it in West Virginia and as Dr. Mitchell sees it in Memphis. In 1921 I started a spot map of children in my own private practice who had bacillary dysentery. A child who, from the time he was born to the fifth year, had dysentery was put down as a solid black circle, and the residence in which he lived at the time he had dysentery was noted. If the child went five years without dysentery, he was given credit with a plain circle in the district in which he lived most of that five-year period. I was able to gather three hundred children who could be considered acceptable from a statistical and factual standpoint. This group was compared to another group from a baby welfare clinic and a similar spot map was made for the same period. These cases were studied for their proximity to poor hygienic and bad sanitary conditions, such as open unsanitary privies, toilets that were not connected to the regular sanitary sewers but which emptied instead into a ravine or into the street. Barns, horses, and livestock were practically nonexistent. The most favorable position in town was to be found in the part in which the homes were most completely sanitated and where living conditions were generally above the average. This was generally the section in which there was little overcrowding and the economic conditions were the best. There the percentage of cases of dysentery was only 15 per cent, while in the worst section of town, which had little or no sanitary sewage disposal, the percentage was over 80 per cent. I feel that we have clearly demonstrated the influence of lack of community sanitation on the incidence of bloody diarrhea in a community.

There was one section that was quite interesting in that it is a beautiful park section. The most expensive and beautiful homes were to be found therein. The houses were separated to such an extent that there was no problem of overcrowding. The people were of the highest economic status. In spite of all of this, approximately 50 per cent of the children in this select district had dysentery. The reason for it was that all of the homes along that section bordered on a creek and some forty to eighty homes had their sanitary sewers entering this creek. In the summer season the water was insufficient to flush it, and one could see toilet paper and other evidences of human sewage accumulated in the creek. This provided optimal opportunities for flies and the spread of dysentery in the immediate neighborhood of the creek.

We also showed an important relationship between flies and the incidence of dysentery in a rather controlled group in the coal mining camps where people lived in an urban type of congestion with rural type of sanitation. There were practically no cesspools or privies of the accepted type. Quite frequently the privies were built out over an ordinary creek or small ravine, and the excreta were dropped unprotected there. At certain times of the year, there would be little or no water. A heavy infestation with flies was the rule. I doubt very much if there is a place in the United States that offers any more favorable opportunity for the spread of dysentery than we have had in Logan County, with its peculiar type of localized congestion. People there live with almost complete lack of community sanitation, and yet they live almost as closely crowded together as in the tenements of New York City. Our mining and locally congested mountainous sections are hotbeds of intestinal infection and act as "community foci" of infection in the spread of these diseases

to other states. Convalescent and other types of carriers are egressing from these centers with greater ease and regularity since the development of travel by automobile and good roads. Bacillary dysentery is being disseminated in a way that did not exist thirty years ago and to an ever increasingly important degree as well. For that reason dysentery is an interstate problem rather than an intrastate problem. There has been a remarkable increase in the amount of dysentery in many more northern localities. The "bloody flux" is by no means uncommon in southern Indiana. It is very uncommon in Ohio, from Columbus south. The departments of health in the more northern states do not seem to recognize it as of such importance as do those of the southern states. There may be other states with just as bad community sanitation as that of West Virginia, but the fact that the population is more generally scattered and not so locally congested probably prevents their having such frequent epidemics. In West Virginia and other parts of the southern states it occurs in truly epidemic form. In our locality we have had the same experience as Dr. Mitchell cited. We also have flies the year around. I believe dysentery can be prevented only by the institution of a good community sanitation program. In the absence of such a program it should not be considered a black mark against the pediatrician if patients under his care develop dysentery. I feel helpless in my community in attempting to prevent my private patients from getting dysentery. It is a problem we should become interested in—that is in educating the public to the need for good community sanitation. (From Am. J. Dis. Child. 49: 367, 1935.)

DR. MITCHELL.—Dr. Lyon, do you have the severe type of dysentery I described?

DR. LYON.—Yes, but it is not always of the Shiga type. We have almost never recovered a Shiga organism in any of our cases. In 1926 during one week, we had four adults die in one city block of true Flexner dysentery of a virulent type. We also have a fairly high mortality among our young adults and older people. We have not been able to prove this to be of the Shiga type. Most of the cases we have been able to culture have been of the Flexner type. We felt that, just as happens with the typhoid bacillus, some strains may be particularly virulent rather than a different type or organism. I am reminded of an experience we had in Baltimore. A child was brought in unconscious, no diarrhea, no vomiting, but with the most profound toxemia and meningeal signs. There was no remarkable leucocytosis. We did a lumbar puncture and found a normal spinal fluid. An x-ray of the chest was negative. Enemas for three days showed nothing remarkable in the fecal matter returned. On the fourth day, the child had bloody stools, almost pure blood. His temperature began to recede, and he recovered after a typical course of "bloody diarrhea." Some patients may die from the toxemia. Then we have the other type, in which it is a matter of dehydration or acidosis. We can do something for the patients in whom it is a matter of water deprivation, but we are largely helpless in the cases of profound toxemia in which there is no great loss of fluid; these children generally have no particular loss in weight and may live for only two or three days. Intravenous glucose solution and calcium gluconate seemed to be of most benefit. Our experience with blood transfusions in this form has been very disappointing.

DR. BASHINSKI.—Do you have very much amebic dysentery?

DR. LYON.—We have practically none. With us there is a great difference clinically between the occasional amebic dysentery which we see and the common type of bacillary dysentery.

DR. MITCHELL.—We had one instance in which twenty-seven nurses developed dysentery. Each nurse in the cafeteria would scoop ice out of a container with her hand and put it in her glass of water. We had one carrier.

DR. BASHINSKI.—In Georgia we have quite a bit of amebic dysentery in children due to lack of sanitation in small communities. Oftentimes when one sees them in the beginning, one does not recognize the condition, but on close examination one finds it is amebic dysentery.

CHAIRMAN DAVISON.—Do these patients die?

DR. BASHINSKI.—Quite a few.

CHAIRMAN DAVISON.—I have been impressed by the mildness of amebic dysentery. We have had only one death. I wonder if we have a different strain in contrast to the strain in Chicago?

DR. BASHINSKI.—We have a little town out from Macon in which we had several deaths.

DR. LYON.—One thing that has been neglected by many physicians is the tendency toward chronic indigestion after an acute attack of bacillary dysentery. Dr. Howland used to stress this so much. I always explain to the parents of my patients that with any case of bacillary dysentery there are two critical periods: one is the early phase of diarrhea and dehydration, and the other is the postinfection period of indigestion. I have had as bad results from being unable to handle the family in the latter phase as I have had from the difficulties of management of the diarrheal phase. During the acutely sick diarrheal stage, parents generally will be very cooperative. In the equally important, but generally less well appreciated, stage of convalescence and of intestinal sensitivity, the parents tend to be hard to hold in line, and here the "art" of practice is often put to a severe test.

DR. F. ELMER JOHNSON (NEW YORK CITY).—In line with Dr. Lyon's statement, is there anything in the theory that if you give protein foods to dysentery patients they become allergic to that protein?

CHAIRMAN DAVISON.—I have never seen any evidence of it.

DR. JOHNSON.—It has been my experience that many dysentery patients become allergic to milk if they are given milk during their acute stage of illness. With reference to those cases to which Dr. Lyon referred as chronic indigestion, I think many of those patients became allergic to milk because they were given milk during the acute stage of their dysentery. I want to ask particularly what can we do about the epidemics of infectious diarrhea which occur in children's wards among young infants?

CHAIRMAN DAVISON.—The great bulk of those who have fever or sudden onset with more than five or six stools a day with pus or blood have bacillary dysentery. The precautions described earlier usually prevent cross-infections in hospitals. In the Duke Hospital, no one comes in contact with any child in the ward without a mask, or without washing his hands. Flies are kept at a minimum.

DR. MITCHELL.—Dr. Lyon stated that the children who die from dysentery in severe epidemics die because they are "toxic." That has been our experience. At autopsy we found surprisingly little pathology, almost none.

DR. BASHINSKI.—Many of these patients are purged with castor oil and calomel and are killed by starvation.

DR. LYON.—There is nothing much known about the possibility of some infectious diarrheas being of a virus type. In Virginia in September of this last year I saw a type of "dysentery" that had all the characteristics of a virus disease rather than a true bacterial infection, and there was no history of blood or pus in the stools. There were a number of cases of "grippe" and severe abdominal pain in the community at this time.

CHAIRMAN DAVISON.—We saw several of these cases last autumn. The adults had chest pain, and the children had abdominal pain, diarrhea, and leucopenia. They were commonly called "devil's grip" or "pleurodynia."

DR. MITCHELL.—Do you think it makes much difference what you feed dysentery patients so long as you feed them enough?

CHAIRMAN DAVISON.—No, although high protein diets seem to reduce the number of stools more rapidly than do high carbohydrate foods.

DR. JOHNSON.—How can you account for the fact that many of these cases start after the ingestion of green fruit?

CHAIRMAN DAVISON.—Although there may be some relationship, it may be coincidence. As soon as the peach season starts in North Carolina, the mothers of most of our diarrheal patients attribute the cause to the eating of green peaches. In Alabama during the watermelon season, that fruit is implicated.

DR. JOHNSON.—I have seen many children who, after a debauch of raw apple eating, have bloody stools and positive culture. Of course, they may have been carriers.

DR. MITCHELL.—Moro cures these patients by feeding them raw apples.

DR. JOHNSON.—Yes, but those apples are scraped.

DR. BASHINSKI.—What about this condition we diagnose as intestinal influenza with oftentimes fifteen to twenty loose putrefactive stools a day? What class of diarrhea do they represent?

CHAIRMAN DAVISON.—I have seen many of these patients. They undoubtedly have infectious diarrhea although I have cultured them repeatedly and have not been able to recognize any causative organisms.

DR. JOHNSON.—Will the Shiga bacillus cause a type of encephalitis?

CHAIRMAN DAVISON.—The exotoxin of the Shiga bacillus will produce paralysis, but I know of only one child in whom it had this effect. The endotoxins of both the Flexner and the Shiga bacilli apparently can cause convulsions, which may be due to an encephalitic reaction.

DR. J. LEWIS BLANTON (FAIRMONT, W. VA.).—Do you think paregoric has any beneficial action other than that of relief through rest? I know one physician who gives morphine hypodermically and feels it has a beneficial effect.

CHAIRMAN DAVISON.—I think many of these children will recover if they have a chance to rest, but if they are having eighteen to forty stools a day, they get practically no sleep. Paregoric reduces the number of stools, reduces the tenesmus, and gives the infant a rest. I do not know of any other effect. Some physicians advise against the giving of opiates to diarrheal patients.

DR. BLANTON.—It helps the severe dehydration.

CHAIRMAN DAVISON.—It may by reducing the number of stools, but subcutaneous, intraperitoneal, and intravenous fluids usually are necessary.

DR. BASHINSKI.—What is your idea of the amount of fluid to be given subcutaneously—a large amount at one time or small amounts more often?

CHAIRMAN DAVISON.—Smaller amounts at intervals or continuous administration are less painful. Too much fluid can be given to children.

DR. BASHINSKI.—What would you consider the average amount?

CHAIRMAN DAVISON.—We try to get in 1,000 c.c. a day in a child under one year and use 2,000 c.c. as a limit. I have never seen any mathematical rules for the amount.

DR. MITCHELL.—Do you consider it dangerous to give a dehydrated child blood transfusions?

CHAIRMAN DAVISON.—A badly dehydrated child, if given a blood transfusion, may have a much worse reaction than a child to whom 200 to 300 c.c. of intravenous saline or glucose have been given before a transfusion.

DR. JOHNSON.—Have you ever seen children who have been given repeated transfusions for intestinal disease develop necrosis, or high hemoglobin contents, high red blood counts, and perhaps thrombosis? I have an impression it is dangerous to give repeated transfusions to children who have high hemoglobin contents and red blood cell counts.

CHAIRMAN DAVISON.—I have seen several children who had high red blood cell counts and high hemoglobin contents after repeated transfusion, but they did not seem any the worse for them.

DR. LYON.—We had a rather bad experience with blood transfusions in typhoid fever in which we used the blood of adults who have previously had typhoid fever. We felt it might be helpful, but it was quite the opposite. Such reactions as we had from these immunotransfusions, we have never before witnessed. In one instance the temperature rose within two hours to 109° F., and the leucocyte count fell from 3,100 to less than 800. There was no evidence of ordinary blood incompatibility of the usual type and no red cell destruction or subsequent urinary evidences of erythrocyte destruction. Death occurred within forty-eight hours without the leucocyte count's returning to 1,000. The transfusion was given in the fourth week of illness, and the patient's condition previously had not been alarming. The patient was eight years old. A similar thing might occur if the donor had had dysentery, and the serum contained antibodies.

CHAIRMAN DAVISON.—The antibodies in dysentery usually remain so low that little or no immunity is produced. Repeated attacks occur.

DR. W. D. LYON.—Years ago I came to the conclusion that with camphor in paregoric we obtained not only a reduction of peristalsis but also an astringency we never got with any other opiate.

CHAIRMAN DAVISON.—Paregoric seems to produce better results than do other opium preparations. The general rule I follow is to give patients 10 drops after each stool up to a maximum of 60 to 120 drops, depending on the age of the patient.

DR. LYON.—I have used tea since 1921 and let the children have it sweetened. I still feed my diarrheal patients with a cultured lactic acid milk, paregoric, and tea, and I feel that they get along decidedly better than those who have been allowed to have other foods. These children also take large amounts of a 10 to 15 per cent glucose solution by mouth with great benefit.

DR. JOHNSON.—In your introductory remarks you said there were certain conditions which must be differentiated. You mentioned ulcerative colitis. Isn't that dysentery?

CHAIRMAN DAVISON.—I always thought it was, but recently we had a child in the hospital who had eighteen stools a day without blood, but with a large amount of pus. We examined and cultured the stools repeatedly and performed many agglutination tests with the patient's serum but could find no evidence of dysenteric infection, and finally made the diagnosis of ulcerative colitis.

DR. BASHINSKI.—Do you think this condition was due to the gas bacillus?

CHAIRMAN DAVISON.—Gas bacilli can be found in so many normal persons that I do not believe they cause diarrhea.

DR. ELMER W. BARRON (BOSTON, MASS.).—We see practically no cases of dysentery at present. During the past three years, we have had only four cases of proved dysentery, although late in September and October we do have some cases of diarrhea which we are unable to classify etiologically. As far as treatment is concerned, I think most of us still feel a moderately low fat diet is indicated. I can look back to 1910 when they used to put these patients on starvation diets and give them nothing but water. I can remember when these children were kept ten days without anything but water.

DR. LYON.—That is almost a routine in Denmark.

CHAIRMAN DAVISON.—Dr. Finkelstein used to starve them four or five days. The tough ones would recover; the others succumb. We try to feed them from the start. One thing that interests me very much is why the intraperitoneal administration of salt solution has gone out of fashion.

DR. BARRON.—We do not use it at all. The technic of the younger men is so good on intravenous administration that they feel it is easier.

DR. MITCHELL.—We do not use it. We give fluid subcutaneously or intravenously. For two years we ran some rather careful experiments on our proved cases of dysentery. We fed some of them powdered milk, some sweet milk, and various types of milk with and without lactic acid. We did not find a bit of difference. We put the older children on a regular soft diet, well balanced, and I could not see that the lactic acid made any difference.

DR. BARRON.—We could not see any difference between lactic acid and any other milk.

CHAIRMAN DAVISON.—I believe that the sole benefit of lactic acid is that it produces a noninfectible milk, a preventive measure. Dr. Rothey added dysentery and typhoid bacilli to lactic acid milk, and they were killed.

DR. BARRON.—Somebody claimed several years ago he found dysentery bacilli in standard brands of condensed milk and purchased in four or five different stores.

DR. LYON.—We recently had in Parkersburg, W. Va., an epidemic of typhoid fever and it was traced to buttermilk. That is the only one ever reported.

CHAIRMAN DAVISON.—Buttermilk usually contains enough lactic acid to kill typhoid bacilli.

DR. LYON.—The West Virginia Department of Health found the organisms.

DR. JOHNSON.—How much time is required for the development of dysenteric ulcerations?

CHAIRMAN DAVISON.—Usually two days, although I have seen children with no symptoms prior to twelve hours before death in whom ulcerated intestines were found at autopsy.

CHAIRMAN DAVISON.—Usually the patients who survive the first twelve days recover.

DR. LYON.—Another thing about the contagiousness of these infectious diarrheas: Dr. Freeman and Dr. Levy, in Richmond, some twenty-five or thirty years ago, made an excellent study which has not been published. The city of Richmond had been "sanitated." A large decrease in their infant death rates and morbidity from diarrheas had been predicted. While there was some reduction, it was not as much as had been expected, and there was some degree of disappointment experienced. To study the importance of handling the diapers of babies in the individual homes and other matters of hygiene and sanitation within the home, the

public health nurses were concentrated in one district of ten city blocks. They went from home to home and actually instructed the parents and saw that the babies' diapers were placed in fly-proof containers just as soon as they were soiled. The parents were instructed against other forms of faulty personal sanitation. As a result, the incidence of dysentery and other diarrheal disease was greatly reduced.

The meeting was adjourned.

News and Notes

The following men have been certified by the American Board of Pediatrics since the last report:

Dr. Irvine McQuarrie, Minneapolis, Minn.
Dr. Faith Frances Hardy, Grand Rapids, Mich.
Dr. L. Paul Sonda, Detroit, Mich.
Dr. David Wolin, Rochester, N. Y.
Dr. Barnet E. Bonar, Salt Lake City, Utah
Dr. Norman Ward Clein, Seattle, Wash.
Dr. Samuel James McClendon, San Diego, Calif.
Dr. Walter Bale Seelye, Seattle, Wash.
Dr. Glenn Simpson, Victoria, B. C.
Dr. Raymond H. Somers, Seattle, Wash.

In this group six were certified by examination.

The Babies and Childrens Hospital of Cleveland was opened on Aug. 5, 1935. The service now includes the care of surgically ill infants and children. This part of the work is under the direction of Dr. Carl H. Lenhart, Professor of Surgery at Western Reserve University. The rest of the hospital, including the laboratories, is, as formerly, under the direction of Dr. Henry J. Gerstenberger, Professor of Pediatrics at Western Reserve University.

Dr. Paul György, formerly of the pediatric department of the University of Heidelberg (Professor Ernst Moro), who has since September, 1933, been working in the Physiological Laboratory of the University of Cambridge (Professor Sir Joseph Barcroft) and in the Nutritional Laboratory of the Medical Research Council (Dr. L. J. Harris, Director), has joined the staff of the Babies and Childrens Hospital of Cleveland and that of the Department of Pediatrics of Western Reserve University.

Book Reviews

Child Psychiatry. Leo Kanner, M.D. Charles C. Thomas, Springfield, Ill., 527 pages. Price, $6.00.

The increasing interest of physicians in the personality disorders of children has foreshadowed for several years the appearance of a text on child psychiatry or preferably "psychobiology." In fact, such a book has been discussed many times. Psychiatrists in general have held to the view that such a text should be written by a pediatrician, and pediatricians have been of the opinion that it should be the work of a psychiatrist. The psychiatrist has held the view that his knowledge of children was insufficient and that this was the important factor, while the pediatrician has regarded psychiatry as something shrouded in mystery and awe. While Dr. Kanner is a psychiatrist, it is obvious that he has learned a great deal about children in his close association with the pediatric clinic at Johns Hopkins Hospital. With the exception of the last twenty-five pages—only this small section being devoted to the "Major Psychoses"—the subject matter discussed shows how closely the two fields are intertwined and overlap and further the impossibility of separating the psychobiologic side of pediatrics from the field of physical growth and development and from disease processes.

As a whole, Dr. Kanner has succeeded most admirably in his task. This text is a pioneer effort and is an oasis among the numerous so-called texts on child psychology and behavior with which we have been flooded in recent years, so many of which have been written by individuals totally unqualified for the task of presenting the problem of personality problems in children from a broad viewpoint. Subsequent editions of this text will probably show considerable modification of emphasis, and undoubtedly there will be similar texts by other authors which will vary considerably in arrangement and discussion. To point out some of the minor disagreements would be simply to emphasize personal viewpoints of the reviewer over controversial matters. These are minor and are of little importance when the text as a whole is considered.

The text is divided as a whole into two parts and each part into sections. Part I considers "The Basic Principles." The first section deals with the methods of studying children's psychiatric problems and the principles of the psychobiology of childhood. In discussing the various "schools of psychology," we find that Dr. Kanner is quite eclectic. We emphasize this, for if it were not the case, we feel the text as a whole would have been doomed to failure and would have turned out to be another case of special pleading. The generalization of a "school" from a few facts has been one of the most important factors in creating the chaos which exists in the field of child psychology. The second section takes up the question of "Examination and Diagnosis," and chapters are devoted to such factors as age, intelligence, sex, environment, etc. The third section discusses general therapeusis and in more detail work with the child and the family.

The first section of Part II deals with personality difficulties forming essential features or sequelae of physical illness. Here we find a discussion of such important subjects as encephalitis, chorea, and the endocrinopathies. The second section is given to a discussion of "involuntary part dysfunctions" as a cause. Topics are arranged by anatomic systems. It includes such conditions as enuresis, tics, and psychogenic vomiting. The third section discusses the "difficulties expressing them-

selves clearly as whole dysfunctions of the individual.'' Here we reach the field which is perplexing to both the pediatrician and the psychiatrist and which has been rapidly developed by the child guidance movement. It is the field into which the so-called clinical psychologist has brought so much confusion. Some of the material here may be considered as controversial since it is the field in which considerable difference of opinion exists. Speech disorders, emotional disorders, antisocial trends, sexual difficulties, sleep disturbance, and the like are thoroughly discussed. The material is well documented by case reports. Only the final chapter is given over to the major psychoses.

Dr. Kanner's text is the first book in English on child psychiatry. It is not only a much-needed book but one very worth while, and the author is to be commended for the thoroughness of this pioneer effort. It should be in the library of every pediatrician and on the ''required list'' for reading and study. It solves the problem for the teacher of pediatrics who has been hard pressed in the past to answer the frequent demand for a book on the personality difficulties of children.

B. S. V.

The Journal of Pediatrics

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